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Development of a sustainable Lean Six Sigma framework in Healthcare Sector

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for the degree of Doctor of Philosophy

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Abstract

The healthcare sector is promoting the use of process improvement approaches resulting in several successful improvement projects. However, evidence, based on literature, points out that in a significant number of cases, healthcare organisations have failed to sustain the deployment of process improvement tools for long-term continuous improvements. Lean Six Sigma, which incorporates the speed and impact of Lean, with the quality and variation control of Six Sigma, is considered to have a high impact. Nevertheless, to reap the full benefits of LSS, it is necessary to develop a systematic approach to sustain LSS in healthcare organisations. Organisations have been shown to approach change from only three ways: functional, operational and ad hoc, neglecting a holistic or systemic analysis. Hence, the literature has not provided a systemic approach to change and improvement, which also includes the assessment of readiness for change.

Therefore the objectives are to carry out an extensive literature review and survey to identify the reasons for organisations failing to sustain Lean Six Sigma. A list of factors critical for successfully sustaining Lean Six Sigma are identified and analysed using the ISM methodology. With the view to support healthcare professionals in integrating Lean Six Sigma in their organisation, this research develops a new framework (SLSS) to shift focus away from short term and towards long-term improvement. Furthermore, using a semi structured interview approach experts validate the framework. The framework will allow professionals to pay more attention on strategically important factors when integrating Lean Six Sigma in their organisation.

The major outcome of this research is that the relationship between CSFs is analysed providing a distinctive view on how to handle them. Common approaches have focused on other aspects of research and were content with having identified CSFs, which led to the misconception that all CSFs are equally important. Hence, this research provides a more sophisticated view on this topic. In addition, the SLSS framework was build to fill the gap between implementation-focused and organisational culture focused frameworks. It can be used in conjunction with the organisation's preferred implementation framework in order to guarantee that the strategic component is covered.

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Table of Contents

Abstract	II
Acknowledgements	IV
List of Figures	VIII
List of Tables	IX

CHAPTER 1: INTRODUCTION

1.1 Background	2
1.2 Research Aim and Objectives	3
1.3 Outline of the Thesis	4

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction	8
2.2 Healthcare vs Manufacturing	8
2.3 Lean	9
2.3.1 Background	9
2.3.2 Use in Healthcare environment	11
2.3.3 Critical view of Lean	15
2.4 Six Sigma	15
2.4.1 Background	15
2.4.2 Use in Healthcare environment	16
2.4.3 Critical view of Six Sigma	17
2.5 Lean Six Sigma	17
2.5.1 Synergy of Lean and Six Sigma	18
2.5.2 Use in Healthcare environment	19
2.5.3 Lean Six Sigma range of tools	20
2.5.4 Critical view of Lean Six Sigma	24
2.6 Change - Issues that Inhibit Sustainability in Healthcare	25
2.7 Change - Different Approaches	28
2.8 Critical Success Factors	34
2.9 Rationale for Research	36
2.10 Conclusion	38

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction	40
3.2 Research Design and Methodology	40
3.2.1 Research purpose	41
3.2.2 Research approach	42
3.2.2.1 Empirical versus theoretical	43
3.2.2.2 Inductive versus deductive	43
3.2.2.3 Qualitative versus quantitative	44
3.2.3 Research strategy	45
3.2.4 Data collection methods	46
3.2.4.1 Secondary data	46
3.2.4.2 Primary data	47
3.2.4.2.1 Focus Groups	48
3.2.4.2.2 Interviews	48
3.2.4.2.3 Questionnaires	49
3.3 Summary of methods used in present study	54
3.4 Design of this research	55
3.4.1 Literature Review	55

3.4.2 Questionnaire design and implementation	56
3.4.2.1 Pilot questionnaire	57
3.4.2.2 Questionnaire data collection	57
3.4.3 Interpreting Structural Modelling (ISM)	58
3.4.4 Semi-Structure Interview	61
3.5 Conclusion	62

CHAPTER 4: THE USE OF LEAN SIX SIGMA IN HOSPITALS

4.1 Introduction	64
4.2 Determination of the Survey Sample	64
4.3 Questionnaire Design	65
4.4 Conducting the Survey	66
4.5 Survey Analyses and Results	67
4.6 Limitation	75
4.7 Conclusion	76

CHAPTER 5: IDENTIFICATION AND ANALYSES OF CRITICAL SUCCESS FACTOR

5.1 Introduction	79
5.2 Determination of CSFs	79
5.2.1 Mapping Literature	80
5.2.2 Evaluation of Secondary Data	81
5.3 Final CSFs	85
5.3.1 <i>Top Management Commitment</i>	85
5.3.1.1 Barriers	86
5.3.1.2 Ways to overcome Barriers	86
5.3.2 <i>Clear Vision</i>	87
5.3.2.1 Barriers	88
5.3.2.2 Ways to overcome Barriers	89
5.3.3 <i>Training/Education</i>	89
5.3.3.1 Barriers	91
5.3.3.2 Ways to overcome Barriers	91
5.3.4 <i>Communication at all Levels</i>	92
5.3.4.1 Barriers	93
5.3.4.2 Ways to overcome Barriers	94
5.3.5 <i>Resources</i>	95
5.3.5.1 Barriers	97
5.3.5.2 Ways to overcome Barriers	97
5.3.6 <i>Incentive-System</i>	98
5.3.6.1 Barriers	99
5.3.6.2 Ways to overcome Barriers	100
5.3.7 <i>Project Management</i>	100
5.3.7.1 Barriers	101
5.3.7.2 Ways to overcome Barriers	102
5.3.8 <i>Sense of Urgency</i>	103
5.3.8.1 Barriers	104
5.3.8.2 Ways to overcome Barriers	104
5.3.9 <i>Understanding of processes</i>	106
5.3.9.1 Barriers	107
5.3.9.2 Ways to overcome Barriers	107
5.3.10 <i>Clear Goals</i>	108
5.3.10.1 Barriers	109

5.3.10.2 Ways to overcome Barriers	110
5.3.11 <i>Performance Measurement</i>	111
5.3.11.1 Barriers	113
5.3.11.2 Ways to overcome Barriers	114
5.4 Relationship and sequence between CSFs	116
5.4.1 Interpretive Structural Modelling	116
5.4.2 Data Analysis	117
5.4.3 Results and Discussion	125
5.5 Conclusion	129

CHAPTER 6: THE PROPOSED FRAMEWORK ELEMENTS & STRUCTURE

6.1 Introduction	131
6.2 Structure of the Framework	131
6.3 PHASE A	134
6.3.1 Lewin's Resistance Vs Pro Change	135
6.3.2 Strebel's Change path	137
6.3.3 Define Nature of Change	140
6.4 PHASE B	140
6.4.1 Create Sense of Urgency	141
6.4.2 Create Clear Vision	145
6.4.3 Secure Top Management Commitment	148
6.5 PHASE C	150
6.5.1 Provide Sufficient Resources	150
6.5.2 Provide Training/Education	153
6.5.3 Introduce an Incentive System	157
6.5.4 Enhance Understanding of Processes	159
6.5.5 Support Communication at All Levels	162
6.5.6 Create and Define Performance Measurements	164
6.5.7 Define specific Goals	168
6.6 PHASE D	172
6.6.1 Follow Rules of Project Management	172
6.7 Conclusion	175

CHAPTER 7: EVALUATION OF THE FRAMEWORK

7.1 Introduction	177
7.2 Theoretical Evaluation	177
7.3 Evaluation by Interview	178
7.3.1 Questionnaire design	179
7.3.2 Background to Interviewees	179
7.4 Results & Proposed Changes	181
7.5 Refined SLSS framework	184
7.6 Conclusion	186

CHAPTER 8: CONCLUSION, IMPLICATION AND FUTURE RESEARCH

8.1 Introduction	188
8.2 Research Objectives and Achievements	190
8.3 Contribution to Knowledge	196
8.4 Research Limitations	198
8.5 Recommendation for further research work	199

REFERENCES	201
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BIBLIOGRAPHY	211
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APPENDIX A:	Hospital Survey-Questionnaire
APPENDIX B:	Performance Measurement type & hazard
APPENDIX C:	MICMAC threshold shift analysis & ISM Questionnaire
APPENDIX D:	Validation Questionnaire with summarised results

List of Figures

Figure 2.1: BICS improvement Cycle	12
Figure 2.2: VMMC strategic plan	14
Figure 2.3: Taxonomy of Lean Six Sigma	18
Figure 2.4: Synergy between Lean and Six Sigma based on DMAIC	19
Figure 2.5: Fishbone diagram for waiting time	21
Figure 2.6: Typical healthcare stakeholders	26
Figure 2.7: Strebel's Change Path	31
Figure 3.1: Literature sources	55
Figure 3.2: Methods used to address research objectives	63
Figure 4.1: Support of Lean and/or Six Sigma	68
Figure 5.1: The ISM of sustainable LSS CSFs	124
Figure 5.2: MICMAC analysis	125
Figure 6.1: The proposed SLSS framework	133
Figure 6.2: SLSS - PHASE A: Identification and analysis of forces	135
Figure 6.3: Lewin's Force field Analysis	136
Figure 6.4: SLSS - PHASE A: Change Path - Reactive or Proactive?	137
Figure 6.5: Revised change path diagnostic	138
Figure 6.6: SLSS - PHASE B: Creating Sense of Urgency	141
Figure 6.7: A way of creating Sense of Urgency	142
Figure 6.8: SLSS - PHASE B: Create Clear Vision	145
Figure 6.9: A way of creating a clear vision	146
Figure 6.10: SLSS - PHASE B: Secure Top Management commitment	148
Figure 6.11: A way of securing Top Management commitment	149
Figure 6.12: SLSS - PHASE C: Provide sufficient Resources	151
Figure 6.13: What to consider when providing sufficient Resources	151
Figure 6.14: SLSS - PHASE C: Provide Training/Education	153
Figure 6.15: Providing Training/Education	154
Figure 6.16: SLSS - PHASE C: Introduce an Incentive system	157
Figure 6.17: Components of an Incentive system	157
Figure 6.18: SLSS - PHASE C: Enhance Understanding of processes	159
Figure 6.19: A way of understanding processes	160
Figure 6.20: SLSS - PHASE C: Support Communication at all levels	162
Figure 6.21: What to consider for communication at all levels	162
Figure 6.22: SLSS - PHASE C: Create and define Performance Measurements	164
Figure 6.23: A way of creating and defining Performance Measurements .	165
Figure 6.24: SLSS - PHASE C: Define specific Goals	168
Figure 6.25: What to consider when defining specific Goals	169
Figure 6.26: SLSS - PHASE C: Follow rules of Project Management	172
Figure 6.27: Components of a successful Project Management	173
Figure 7.1: Interviewee's work experience	180
Figure 7.2: Final SLSS-framework	185

List of Tables

Table 2.1: Lean methodology	10
Table 2.2: Seven wastes in Healthcare	11
Table 2.3: Six Sigma methodology	16
Table 2.4: Kotter's eight steps to transforming an organisation	30
Table 2.5: Ambrose's recipe for successful change	32
Table 4.1: Experience with Lean and/or Six Sigma	67
Table 4.2: Formal training in L/SS	69
Table 4.3: List of L/SS tools used	70
Table 4.4: Project prioritisation	71
Table 4.5: Project initiation	71
Table 4.6: Composition of project-teams	71
Table 4.7: Extent of nurse's involvement	71
Table 4.8: Level of project goals understanding	73
Table 4.9: Information flow	73
Table 4.10: Staff supported to speak out freely	74
Table 4.11: Structured Implementation Approach	74
Table 5.1: CSFs for sustainable Lean Six Sigma in healthcare, mentioned in literature	81
Table 5.2: Evaluation of papers of CSF for LSS integration, after McCasten	82-84
Table 5.3: Critical Success Factors for sustainable Lean Six Sigma	117
Table 5.4: Structural Self-Interaction matrix (SSIM)	118
Table 5.5: Initial Reachability matrix	119
Table 5.6: Final Reachability matrix	120
Table 5.7: First Iteration for Level I	121
Table 5.8: Second Iteration for Level II	121
Table 5.9: Third Iteration for Level III	121
Table 5.10: Fourth Iteration for Level IV	122
Table 5.11: Fifth Iteration for Level V	122
Table 5.12: Sixth Iteration for Level VI	122
Table 5.13: Seventh Iteration for Level VII	122
Table 5.14: Conical matrix	123
Table 6.1: Performance Measurements Characteristics for Prioritisation Purposes	166
Table 8.1: Research objective: lit review	191
Table 8.2: Research objective: conduct survey	192
Table 8.3: Research objective: analyse survey and Lit rev.	193
Table 8.4: Research objective: develop framework	194
Table 8.5: Research objective: validate and refine framework	195

CHAPTER 1:

INTRODUCTION

1.1 Background

Given the rising cost of medical care and the increasing demand for high quality and prompt services, healthcare organisations around the world are promoting the use of process improvement approaches. For example, the biggest healthcare system in the world, the National Health Service (NHS) has been promoting use of process improvement approaches since 2000 under a 10-year modernisation plan spearheaded by the government. Literature reports a range of applications where process improvement approaches, in particular Lean and/or Six Sigma, have been successfully used (Fillingham 2007, Kelly et al. 2007, de Koning et al. 2006).

Having realised the benefits of using Lean and/or Six Sigma (L/SS) to address specific issues, the healthcare sector is attempting to integrate L/SS to achieve long-term continuous improvements. However, only a few hospitals have managed to sustain process improvement efforts (Radnor and Bucci 2008). Lean Six Sigma, which incorporates the speed and impact of Lean, with the quality and variation control of Six Sigma, is considered to have a high impact. Given this desirable outcome, healthcare organisations are currently endeavouring to implement Lean Six Sigma (LSS). However, to reap the full benefits of LSS, it is necessary to develop a systematic approach to sustain LSS in healthcare organisations.

This research is concerned with sustaining LSS in healthcare, where sustaining is defined as integrating LSS into an organisation, making it part of the way business is conducted (maintaining a process of quality improvement). Therefore, organisations need to know what to take into consideration in order to successfully sustain LSS.

An extensive literature review revealed that:

- No systematic approach has been devised to implement and sustain LSS in the healthcare sector.

- In most cases, healthcare organisations have failed to sustain the use of LSS. Healthcare organisations have suffered from inconsistency regarding the use of process improvement approaches. Improvement approaches such as Total Quality Management (TQM) and Theory of Constraints or Business Process Reengineering (BPR) have been used for a while, but were then discarded to make way for new approaches. The lack of long-term commitment towards a process improvement approach has led to project-based improvements and not organisation-wide change. It has become clear that the common feature of LSS and other process improvement techniques is based on the commitment of an organisation to change its way of thinking and working.
- All cases had their focus on implementing LSS and addressing specific issues such as reducing patient length of stay (LOS) and medical errors. These issues were tackled by using one of two approaches: DMAIC (Define, Measure, Analyse, Improve, Control) or PDCA (Plan, Do, Check, Act). DMAIC in particular has been reported in the majority of cases. This approach addresses sustainability with its last step, "Control". In fact, a trend was noticed to address the sustainability issue at the end of frameworks. Many frameworks were derived from DMAIC and kept the focus on sustainability at the last step. Even towards the end of this research frameworks were published following this trend (Kumar, Antony and Tiwari 2011).

Given these premises, a research programme was established to develop a framework that sustainably integrates LSS in healthcare.

1.2 Research Aim and Objectives

This research aims to **develop a framework that supports healthcare professionals to sustain Lean Six Sigma in their organisation**. The outcome of this research will provide a framework and process, which will assist healthcare professionals in integrating LSS in their organisation. In order to fulfil the research aim, the following research objectives are proposed:

- (1) To conduct a thorough literature review to identify recent developments and research work undertaken in LSS in relation to sustaining the benefits.
- (2) To conduct a comprehensive survey to assess the implementation of L/SS in the healthcare sector.
- (3) To analyse survey and literature data to identify key reasons behind organisations' inability to sustain LSS
- (4) To develop a framework to support sustainable LSS in the healthcare sector.
- (5) To validate and refine the proposed framework by Interviewing LSS experts.

1.3 Outline of the Thesis

A summary of each consecutive chapter is listed below:

- (2) **Literature Review** - Identifies the need for a sustainable Lean Six Sigma framework in healthcare. It begins by introducing the differences between the healthcare and manufacturing industry and introduces the process improvement approach. Lean, Six Sigma and Lean Six Sigma are separately introduced and discussed. Information concerning the background, cases in healthcare and a critical view on each approach is provided. In addition, presenting issues that inhibit sustainability in healthcare and different change approaches address the sustainability issue. The terminology "critical success factor" is identified as one of the important elements for this research and is accordingly introduced. Finally, the rationale for this research and the conclusion consolidate this chapter.

- (3) ***Research Design and Methodology*** - Defines the purpose, approach, strategy and data collection methods for research. It provides a summary of all methods used in present study and introduces the design of this research. The methods used in this research are: literature review, questionnaire, interpretive structural modelling and semi-structured interviews.
- (4) ***The Use of Lean Six Sigma in Hospitals*** - The actual situation in hospitals around Europe is presented regarding the use of Lean and/or Six Sigma. A survey is conducted resulting in 31 completely filled in questionnaires. The results are analysed in a descriptive manner and key findings are presented.
- (5) ***Identification and Analysis of Critical Success Factors*** - In the first half of this chapter, Critical Success Factors (CSF) are identified and the literature sources are evaluated. Each of the eleven CSFs is introduced and the barriers and ways to overcome the barriers are identified from literature and best cases. In the second half, the identified CSFs interrelationship is assessed using the ISM method. The method provides structure in complex relationships; hence the method is used to obtain a structure of CSFs. Finally, the results are discussed and a MICMAC analysis takes place to observe the possible building of groups.
- (6) ***The Proposed Framework*** - Introduces the structure and elements of the SLSS (**S**ustainable **L**ean **S**ix **S**igma) framework. Each of the four phases of the framework and the elements are introduced. Regarding each element in the phases, possible approaches are provided mainly based on best cases from previous literature (refer to chapter 5) and discussions with practitioners. The proposed framework is built on previous work done in Chapter 2 (theory building), Chapter 4 (assessment of what hospitals are lacking and need), Chapter 5 (identification of CSFs, providing the structure of the framework, and grouping of CSFs resulting in the phases of the framework).

(7) ***Evaluation and Refined Framework*** - Evaluation methods are assessed and theoretical validation is introduced. The proposed framework from Chapter 6 is evaluated based on interviews. The interviews are semi-structured and the results (from interviews with five experts) are summarised and presented. Proposed changes resulting from the interviews' output are collected and assessed based on literature and the researcher's experience. Finally, the changes considered are edited into the framework and the refined (final) SLSS framework is presented.

(8) ***Conclusion, Implications and Future Research*** - Summarises the objectives met from this research. Identifies the contribution to knowledge presented from this research and discusses the underlying limitations. Finally, identifies and presents recommendations for further research work.

The next Chapter presents the groundwork necessary to understand the need for this research. It becomes apparent that research in this area is lacking a structural framework focusing on sustaining LSS. Hence after considering the differences between manufacturing (origin of Lean Six Sigma) and healthcare the approaches are introduced and the sustainability issue is addressed.

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature that is of importance for this research and describes how this research relates to existing works on Lean Six Sigma and organisational change in a healthcare context. It begins by illustrating the differences between the healthcare and manufacturing industry and introduces Lean Management and Six Sigma individually, reviewing the background, use in a healthcare environment and a critical view on both approaches. It continues to introduce Lean Six Sigma and explain the synergy between Lean and Six Sigma, use in a healthcare environment and a brief description of some Lean Six Sigma tools. The review of Lean Six Sigma concludes with a critical view section.

Following the review of Lean Six Sigma the chapter shifts from quality/operations management to change management. The inhibitors to sustainability are presented and different change approaches are introduced. Finally, critical success factors are defined and the rationale for this research is provided.

2.2 Healthcare vs. Manufacturing

Lean Six Sigma has been established for approximately 15 years in various industry sectors (Maleyeff 2007). Lean and Six Sigma individually have a long history in the manufacturing sector; nevertheless the combination of Lean with Six Sigma does not date back that long (refer to Figure 2.3). Despite its origin in the manufacturing sector resulting in industry-related customised tools, it has become highly demanded in other sectors, including healthcare (De Koning 2006). Both academics and professionals agree on the application of Lean Six Sigma in healthcare. Hospitals and manufacturers are similar in many ways, as they are built around a set of interconnected processes, which have to run smoothly in order for the organisation to successfully deliver. Many technical terms relating to the manufacturing industry can be adjusted according to the needs of hospitals. However, it is crucial to note the differences between both

industries for a better understanding of this research's results. Morton and Cornwell (2009) argue that the differences can be categorised in terms of three key elements: unpredictability, professional nature and service orientation rather than production. Unpredictability is something hospitals have to deal with on a bigger scale than manufacturers, as the latter deal with standardised inputs, generating variability internally, where it can be controlled. On the other hand, hospitals lack standardised inputs, as the patient's response to treatment is generally somewhat unpredictable (standardising treatment can succeed to some extent by recognising atypical cases, still leaving a high variability to account for). In addition, task ambiguity is an unpredictable component hospitals have to deal with, as the patient's diagnosis cannot be mapped out like the product's supply chain in manufacturing. It can be unclear whether a condition is life threatening or trivial, despite a referral from GP, as the information might be limited or incomplete. Another distinctive element between both industries is the professional nature of employees. Physicians have far more manoeuvring room than assembly line workers, as this is needed for the complex nature of the profession. Finally, production means in healthcare terms to deliver service by dealing with patients directly. The service orientation in hospitals is unique even across other service industries, as the service will not only be judged by the patient but also by the patient's visitors (and the whole society on a more abstract level). A hospital therefore has to accommodate the visitors as they interpret the delivery of care to the patient, often arrange the discharge terms or act as advocates. Dealing with highs and lows, greatest pleasures and greatest losses, constitutes the complexity of hospitals compared to the manufacturing industry. (Morton and Cornwell 2009)

2.3 Lean

2.3.1 Background

Lean is a management philosophy which has its origin in the early twenty century and was shaped by Henry Ford and Kiichiro Toyoda and Taiichi Ohno from Toyota (Womack, Jones and Roos 1990). It utilises a set of tools that can be applied across all activities of an organization. Lean is guided by a set of

principles that defines the way things are done, the way improvement is handled and the belief of what is possible (BICS 2008). The term 'Lean' was used by Womack and Jones in 1990 and further developed into 'Lean thinking'. Lean thinking is specifying the value desired by the customer, focusing on adding value, driving out wastes, reducing cycle times and ensuring the continuous flow of the product to the customer (Proudlove, Moxham and Boaden 2008). Lean initiatives rely on creating standardized and stable processes to provide quality services or products as efficiently as possible. According to Langabeer et al. (2009 p.14) Lean "embraces a continuous improvement strategy that supports creating simple and direct pathways and eliminating loops or forks in a system". The customer's perspective is therefore crucial in order to define quality, and eliminate non-value added activities (Tsasis and Bruce-Barrett 2008). Table 2.1 shows a breakdown of the focus and methodology of Lean.

Methodology	Lean
Theory	Reducing waste
Application guidelines	Identify value Identify value stream Flow Pull Perfection Often used with PDCA/PDSA
Focus	Is on process flow
Assumptions	Removing waste will improve performance. Many small improvements are better than systems analysis
Primary effect	Reduced flow time
Secondary effects	Less variation, uniform output, less inventory, New accounting system, flow metrics, improved quality
Criticism	No sufficient statistical or systems analysis approach

Table 2.1: Lean methodology
(adapted from Bevan et al. (2005))

The points mentioned in Table 2.1 as application guidelines represent the five principles used by Ford and Toyota. Moos et al. (2010) translated these principles in a healthcare setting:

- First, one has to specify what the customer perceives as valuable (identify value);
- Next, the value stream of each pathway has to be identified (identify value stream);

- Subsequently, the process flow has to be from a patient point of view (flow);
- Pull realises the flow of the patient (pull);
- Finally, accomplish perfection by using frequent Kaizen events (perfection). Such events usually focus on addressing the improvements on a daily base to incrementally change.

2.3.2 Use in healthcare environment

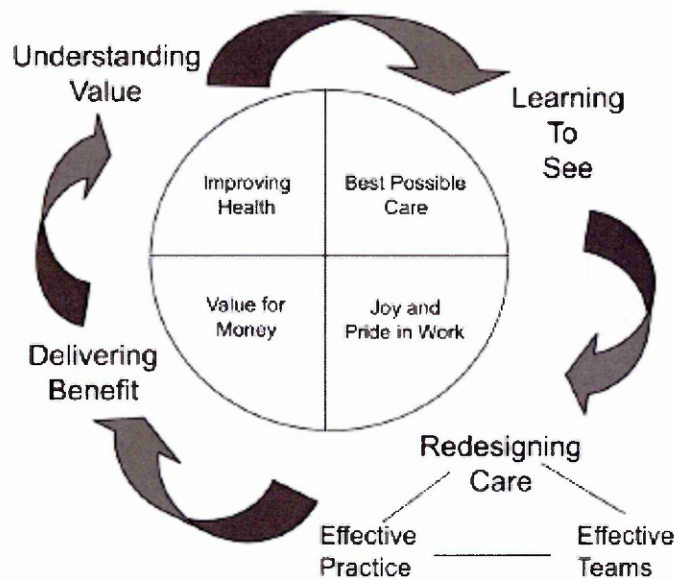
Lean initiatives in healthcare have been reported (Jones and Mitchell 2006; Radnor et al. 2006, Fillingham 2007). VSM (Value Stream Mapping) is a Lean technique that has been used in the NHS since the mid-1990s, mainly by introducing episodic Kaizen events or by combining Lean tools with other improvement approaches. Over time, Lean emerged in the NHS, and is being utilised on a much more systematic basis. This means a number of healthcare organisations focus on organisation-wide value systems to achieve their strategic goals (Bevan et al. 2005). In order to utilise Lean efficiently, it is important to understand the waste relevant in a healthcare environment. Fillingham (2007) adapted Toyota's 7 Wastes (in Japanese referred to as Muda) to a healthcare environment:

Traditional Toyota Waste	Healthcare-Related Waste
Transport	Movement of patients and equipment
Inventory	Unneeded stocks and supplies
Motion	Movement of staff and information
Waiting	Delays in diagnosis and treatment
Overproduction	Unnecessary tests
Over-burden	Stressed, overworked staff
Defects	E.g. medication errors, infections

Table 2.2: Seven wastes in Healthcare (adapted from Fillingham 2007)

Notably advanced healthcare organisations in implementing Lean are Bolton NHS Trust in the UK (Fillingham 2007), Virginia Mason Medical Center and Thedacare in America (Womack et al. 2005) and Flinders in Australia (Ben-Tovim et al. 2007).

Royal Bolton Hospital (RBH) in the UK embedded Lean in their culture by understanding the seven wastes in healthcare and extensively empowering their staff to participate and initiate rapid improvement events where necessary. RBH established the Bolton Improving Care System (BICS), which is an integral part of the Hospital's culture. In order to guarantee that this system is not forgotten, a Multidisciplinary-Team (BICS-Team) was established which leads improvement and gives advice. The BICS improvement cycle is shown in Figure 2.1.



Bolton Hospitals **NHS**
NHS Trust

Figure 2.1: BICS Improvement Cycle (Fillingham 2007, p.234)

1) It starts first with understanding what is valuable to the patient. It is helpful in obtaining this information if BICS practitioners:

- directly observe the patient flow in a clinical area
- integrate patient diaries
- make use of questionnaires, interviews and focus groups
- involve the patient in the project team.

2) Once value is understood it is important to establish if what is being delivered is valuable or not. It is helpful in obtaining this information if BICS practitioners:

- understand the 7 wastes

- empower staff to look out for waste (e.g. once a week healthcare providers are asked to identify at least three problems and solve them with help from the BICS team if needed)
- use 6S: Sort, Straighten, Shine, Standardise, Sustain and Safety
- map the process in a VSM event. Everyone related to the process is actively engaged in mapping the process.

3) The next step is redesigning care. It is helpful in obtaining this information if BICS practitioners:

- get the process flowing from one value-adding step to the next without waste
- institutionalise the new ways of working by standardising the work (using 6S for example)
- create signals to support the pull of patients through the process
- move away from batching. Do not push the patient through the process hoping to speed it up
- finally, design visual management aids in order to see what is happening.

4) The last step is delivering benefit (making sure the changes deliver benefit). It is helpful in obtaining this information if BICS practitioners:

- involve the Executive Board (directors and senior clinical leaders) on a frequent basis (e.g. meeting every month) in order to check what has been done and if the goals have been achieved. If not, a discussion has to take place concerning why goals were not reached and how to solve the problems related to this.

Case: Virginia Mason Medical Center embedding Lean principles (Womack et al. 2005)

Virginia Mason Medical Center (VMMC) has been using Lean since 2002. VMMC focuses on the frequent use of rapid process improvement weeks, in which teams analyse processes, suggest, test and implement improvement in week-long sessions. VMMC created a strategic plan, which is modelled on the Toyota Production System (Figure 2.2).

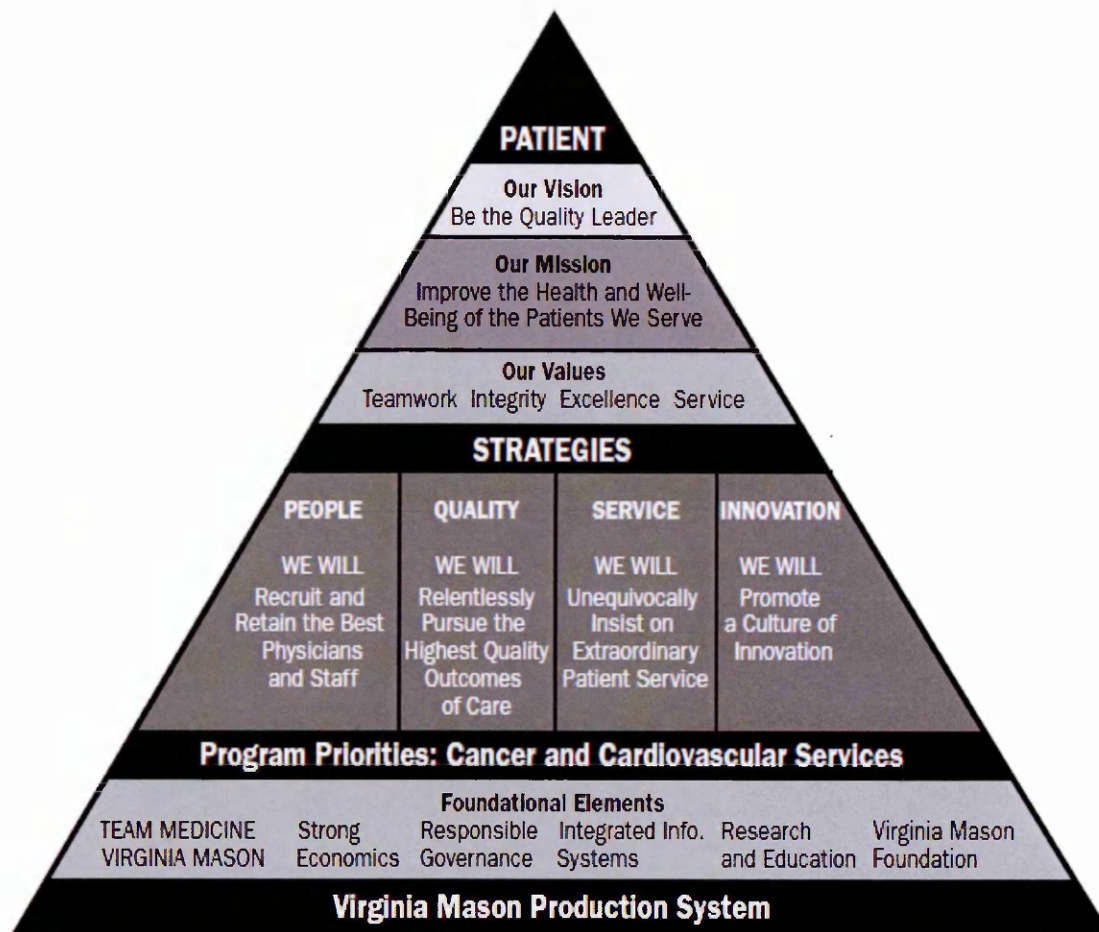


Figure 2.2: VMMC Strategic Plan (Womack et al. 2005, p.10)

- 1) The patient is on top of the pyramid, symbolising that the patient comes first as the driver for all processes.
- 2) The patient is supported by four pillars:
 - People - getting and training the best staff
 - Quality - achieving the best outcome
 - Service - focus on best service for internal and external customers
 - Innovation - supported by a culture of innovation.
- 3) Creating a safe environment and where healthcare professionals feel empowered to engage in improvement (e.g. introducing a "No-Layoff Policy" - ensuring that continuously engaging in improvement does not end in staff losing jobs).
- 4) Implementing a company-wide system which alerts the staff when defects occur, a "Patient Safety Alert System" (known as Jidoka - stopping the line).
- 5) Encouraging innovation by allowing staff to quickly try out new ideas
- 6) Eliminating waste and creating a prosperous and economic hospital.

7) Leadership accountability (hands-on mentality, going to where the process is).

2.3.3 Critical view of Lean

Stamatis (2000) argued that Lean and Six Sigma have a focus on processes rather than on the systems wherein processes operate. Therefore, Lean struggles to be effective when aiming to improve processes within a deep-rooted culture influenced by many stakeholders, as is common in healthcare settings. In addition, Stamatis highlighted that quality can only be improved if the organisation has the commitment to change, making quality a priority or a metric throughout the organisation. Critics argue that Lean is nothing more than a slightly updated Just-In-Time (JIT). According to Suzuki (2004), Lean used to be an important part of JIT and both use a nearly identical toolset. Näslund (2008) argued that Lean emerged from JIT with a similar toolset, approach and similar problems, and characterised it as a fad.

2.4 Six Sigma

2.4.1 Background

Six Sigma was developed in 1986 at Motorola as an improvement concept that focuses on significant reduction of process defects, thereby increasing quality (Langabeer et al. 2009). Customer-driven approach with emphasis on decision-making by carefully analysing quantitative data and cost reduction priority are the defining characteristics of Six Sigma (de Koning et al. 2006). According to Carrigan and Kujawa (2006), the prior objective of Six Sigma is to reduce variability following the assumption that the output of every process falls within acceptable limits. If a process is capable of reaching six standard deviations, only 3.4 defects per million opportunities would occur, taking the 1.5 standard deviation shift in the process mean into account. The implementation of Six Sigma is driven by a core methodology called DMAIC (Define, Measure, Analyse, Improve, Control). This methodology is supported and followed by various companies offering training and certification. Due to Six Sigma's

organisational structure, projects are divided in project leaders such as Black Belts and Green Belts, project owners, and Champions (Pyzdek 2001).

Methodology	Six Sigma
Theory	Reducing variation
Application guidelines	Define Measure Analyse Improve Control
Focus	Problem-solving
Assumptions	Figures and numbers are valued to have a quantitative understanding of the problem that exists. The system output improves if variation in all processes is reduced.
Primary effect	Uniform process output
Secondary effects	Less waste, fast throughput, less inventory, variation metrics, Improved quality
Criticism	The systems interaction (flow) are not considered, therefore processes are improved independently.

Table 2.3: Six Sigma Methodology
(adapted from Bevan et al. (2005))

2.4.2 Use in healthcare environment

There is very little evidence of Six Sigma initiatives in healthcare. Published cases often have their origin in the USA. Six Sigma has been used successfully in a number of cases including improving surgery turnaround time (Adams et al. 2004), hand hygiene compliance (Eldridge 2006) or scheduling radiology procedures (Volland 2005). The USA has a longer history in dealing with Six Sigma, explaining the majority of Six Sigma cases in US healthcare. Additionally, Bevan et al. (2005) report that US healthcare Sigma score mean in 2003 was far beneath 2 Sigma, which translates in 45% of processes being defective. Hence, Hinckley (2003) argued that due to the high mortality rate in 2000 (around 98.000 patients died of adverse events, i.e. mistakes that could have been prevented), US healthcare had a high sense of urgency to change their way of working. These arguments taken into consideration could explain the higher amount of Six Sigma initiatives in the USA compared to the UK.

2.4.3 Critical view of Six Sigma

Seddon (2005) is convinced that the requirements of belt-certification and the strict DMAIC roadmap lead to what he calls 'tool-head' mentality. Critics also argue that Six Sigma's toolset consists of many complicated tools, which unnecessarily delay improvement attempts (Slack et al. 2009). Gupta (2008) stated that Six Sigma projects sometimes cost more than the improvement alone would save. These are some of the disadvantages of Six Sigma that might explain why 60% of all Six Sigma initiatives fail to yield the desired results (Angel and Pritchard 2008). The need of Six Sigma in R&D is widely discussed. Johnson and Swisher (2003) and Bernal (2007) would avoid using Six Sigma in research, because it inhibits creativity and quenches innovation. In contrast, Calabrese (2007), De Palma (2006) and Johnson (2006) showed evidence that Six Sigma by no means inhibits creativity, but has a positive impact on the drug development process.

In addition, tools such as TQM failed because of the language and values used, which caused resistance from staff and physicians (Locock 2003). Six Sigma faces the same disadvantage, and is seen as a temporarily used approach. To tackle this problem, Antony et al. (2007) summarised several critical success factors, including management support, appropriate training and effective communication. Antony (2008) further concluded that Six Sigma has a chance to exist only if it has strong theoretical support and links with other management theories.

2.5 Lean Six Sigma

A leading Lean Six Sigma practitioner, Michael George (2003) stated that Lean Six Sigma has two purposes: to transform the organisation's overall business strategy from vision to reality by selecting and executing appropriate projects; and to create new operational capabilities that will expand the organisation's range of strategy choices.

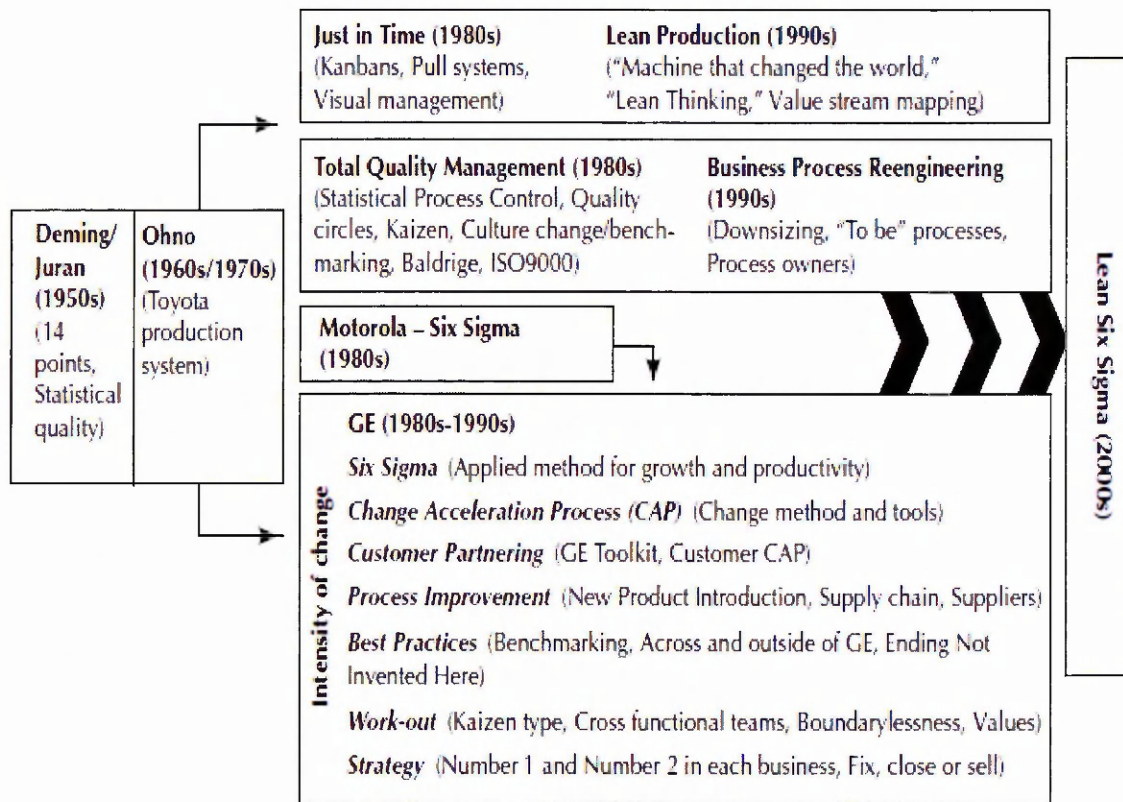


Figure 2.3: Taxonomy of Lean Six Sigma (Maleyeff 2007 p.9)

In addition to what has been explained in the prior sections (2.2 Lean and 2.3 Six Sigma), Figure 2.3 shows all the elements that came together to form Lean Six Sigma.

2.5.1 Synergy of Lean and Six Sigma

Healthcare organisations have achieved impressive results using either Lean or Six Sigma. However, using either of them alone has limitations. According to George (2003): Six Sigma will eliminate defects but it will not address the question of how to optimize process flow; and the Lean principles exclude the advanced statistical tools often required to achieve the process capabilities needed to be truly 'Lean'. Therefore, most practitioners (e.g. George et al. 2005) and academics (e.g. Hines, Holweg and Rich 2004) consider these two methods to be complementary, and while each approach can result in dramatic improvement, utilizing both methods simultaneously holds the promise of being able to address all types of process problems with the most appropriate toolset. Proudlove, Moxham and Boaden (2008) reported that there is no overall

accepted or integrated roadmap for Lean Six Sigma. However, according to George et al. (2005), it is a common approach to integrate Lean tools in the Six Sigma methodology DMAIC.

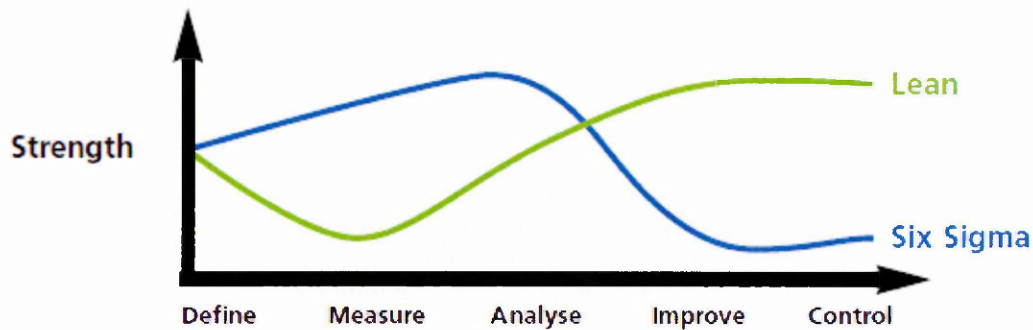


Figure 2.4: Synergy between Lean and Six Sigma based on DMAIC (Bevan et al. 2005, p.13)

Bevan et al. (2005) (Figure 2.4) reported that Six Sigma is dominant in the first three steps (Define, Measure and Analyse), whereas the last two (Improve and Control) are strongly influenced by Lean. However, DMAIC is considered to be difficult to deal with in case of structure and its focus on data. According to Proudlove, Moxham and Boaden (2008), NHS projects tend to skip the unpleasant data-driven steps (the first three steps) of the DMAIC framework and start with Improve.

2.5.2 Use in healthcare environment

Several authors have reported successful applications of Lean Six Sigma (LSS) in healthcare.

- Red Cross Hospital has used LSS to address Complexity Reduction in Hiring Personnel, Reducing Operating Theatres, Starting Times Maintenance and improving maintenance system for managing mechanical breakdowns and irregularities (de Koning et al. 2006).
- University of Iowa Hospital and Clinics and two other Iowa hospitals have tested the adaptability of LSS by identifying and eliminating non-value added activities in Radiology CT scanning. Overall, the LSS project has

increased revenue by approximately \$750,000 per year (Bahensky, Roe and Bolton 2005).

- Minor Treatment Centre in USA faced a capacity constraint with long waiting times. Setting up a standardized registration, standardizing the shift changeover and using the Kaizen approach resulted in a waiting time dropdown of 50%. To assure at the beginning that this was not a temporary experiment, the management made a clear statement that they were serious about the change, by knocking down a new doorway in a wall at 2pm on a busy Wednesday afternoon. After that the staff realised that Lean Six Sigma would not disappear along with the other approaches used, and concentrated on process improvements (Wedgwood 2007).

2.5.3 Lean Six Sigma range of tools

Process mapping

Process mapping shows the workflow in a process or series of parallel processes. It can be distinguished by "High-level view" and "Low-level view". High-level view depicts major elements and their interactions, however the level of detail is very poor and can only be considered early in a project to have an overview on boundaries and scope. Low-level view depicts detailed actions, workflow, rework loops in a process. Besides showing the workflow, process mapping focuses on delivering the current state of a process (As-Is state), an ideal/future state (Should-be state) and the final updated state (To-Be state) (George et al. 2005).

Fishbone diagram

Also called Ishikawa or cause-and-effect diagram, Fishbone diagram helps teams to uncover potential root causes and create a list of ideas by brainstorming in order to overcome the problem (George et al. 2005).

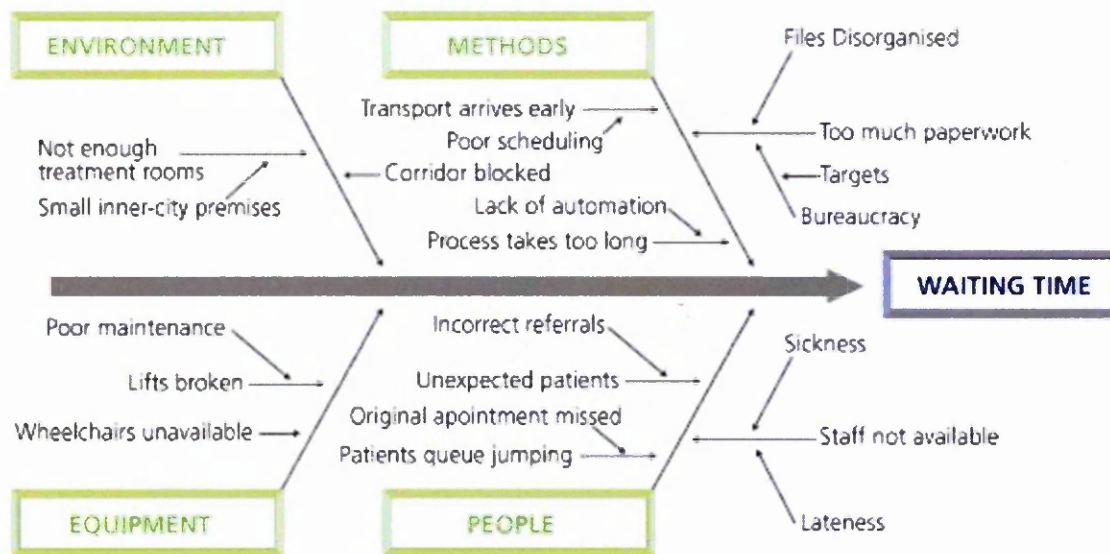


Figure 2.5: Fishbone diagram for waiting time (NHS Institute for Innovation and Improvement 2011a)

Figure 2.5 shows an example of the Fishbone diagram focusing on solving a waiting time problem in a hospital. The big branches (Environment, Methods, Equipment and People) are the major factors, which influence the "effect" waiting time. After brainstorming, more specific possible causes of the problem surface and are added to the branch. A complex cause can be broken down into sub-causes (e.g. "staff not available" is broken down in "lateness" and "sickness").

5S

5S is an approach consisting of five steps, which optimises performance, comfort, safety, and cleanliness. It is used across industries and is part of the *Improve* step of the standard improvement model DMAIC (George 2003). The components of 5S are: Sort; Simplify; Sweep; Standardise; and Sustain (5S is often referred to as 6S in industries where safety is a crucial element, therefore adding another "S" for Safety, which removes all kind of hazards and dangers).

(1) Sorting involves activities such as finding out which items are used more frequently, marking items which are not used, disposing these items and eliminating unwanted items.

(2) The Simplifying step facilitates the access to needed items by arranging

them in the work area according to their frequency of usage.

(3) Sweeping visually as well as physically includes activities such as clearing the work area to ensure everything is in its place and items are up to date.

(4) Standardisation allows a faster location of and information about needed items. Retrieving and returning items or information will be easier for every user due to uniform procedures

(5) Guaranteeing the steps (1) to (4) are sustained by upholding the discipline and maintaining the motivation of the working group.

Often reported benefits from using 5S are reduced cycle times, improved work team performance, improved customer satisfaction and increased profitability. According to Saranapala (2012) the pitfalls of using 5S are underestimating the commitment necessary to successfully implement 5S. It should not be seen as an event but as a process which is continuous and created a disciplined workforce.

VSM

Value stream mapping focuses on the data aspect of a process. Process data such as Work-In-Process, processing time or idle time are being considered as well as the process flow. VSM is mandatory when Lean is used as improvement method, as it helps to find out how to speed up the process and eliminate non-value added steps (George et al. 2005). Common pitfalls of using VSM are reported to be wrong focus on the person doing the work rather than the patient, resulting in wrong mapping. In addition, VSM differs from process mapping in the sense that each data in VSM needs to be personally observed (using engineering standards or predicting the project's potential savings does no work with VSM as it depends on exact data.). (Rother et al. 1999)

5 Whys

5 Whys is a method to get to the root of a problem by asking up to five times "why?". A seemingly unspecific and complex problem can be easily broken down to what really causes the problem. For example, asking five times "why"

discovered the root cause of a problem (why a patient was late in theatre) in a hospital:

The patient was late in theatre; it caused a delay - Why?

There was a long wait for a trolley - Why?

A replacement trolley had to be found - Why?

The original trolley's safety rail was worn and had broken - Why?

It had not been regularly checked/maintained - Why?

The insight attained after this set of questions is that an equipment maintenance schedule is missing (NHS Institute for Innovation and Improvement 2011b). The pitfalls of using 5 Whys are that it does not always help to find the root cause. May it be due to the person questioned not knowing the cause of the problem or the case that there is more than one cause for the problem. It also is not reliable as multiple people can come to a different conclusion. (Anderson 2009)

Pareto analysis

The principle of Pareto analysis is that 80% of the problem comes from 20% of the causes. The Pareto principle enables effort to be designated to the vital 20% of the causes. It is a decision-making tool which allows the user to prioritise possible changes and identify which possible change will most improve the situation. The Pareto analysis is often referred to as 80:20 rule (George et al. 2005).

Project charter

A project charter depicts the scope, objectives and participants in a project. Roles and responsibilities are broadly defined in order to identify the stakeholders and define the authority of the project manager. A project charter is created to answer the following questions: Why do we undertake this project?; What are the objectives and limitations of this project?; How many ways do we have of solving the objectives of this project?; and Who are the stakeholders? (George et al. 2005). In case the organisation decides not to create a project charter, the goals set in the project will be ambiguous and understood incorrectly, hence the possibility of project failure is high (Taylor 2009).

Control chart

Control charts, also called Shewart charts, are used to determine if a process is in a state of statistical control. The process is being frequently monitored by taking samples and measuring its quality to find out as early as possible if the process is out of control. In addition, control charts help distinguish between process variation due to special causes or common causes. A special cause is anything not normal to a process; they are meaningful factors of the process but not always present. On the other hand, common causes are factors caused by chance, therefore always present and unavoidable. Common causes are normal and expected within the process (iSixSigma 2011).

Visual controls

Visual controls enhance workplace efficiency, workplace safety, reduce total cost and improve quality through error prevention, detection and resolution. Clearly labelled storage boards, LED displays or shadow boards are elements of visual controls. If a tray is empty or a tool is missing, staff will pay more attention to fill the tray or find the tool. The purpose behind implementing visual control techniques is to expose abnormalities in the process that could ultimately end up costing the organisation money or create waste. Visual signs will help staff recognizing these abnormalities and correct the problem (George et al. 2005, Black 2008).

Poka-Yoke

Poka-Yoke is referred to as mistake proofing. Unlike the traditional way of inspection, wherein the goal is to detect defects, Poka-Yoke detects the condition that could cause defects and enables the staff to react and correct the mistake before the defect occurs. Poka-Yoke works by setting limits on how a particular process can perform in order to force the process to be done correctly (Hinckley 2003, George et al. 2005, Anand et al. 2009).

2.5.4 Critical view of Lean Six Sigma

As Lean Six Sigma is a combination of both approaches, the critical views from Lean and Six Sigma apply here. Critics like Black (2008) argue that the combination of Lean with Six Sigma is unnecessary and simply complicates the

process improvement programs. He strictly emphasises that one concentrate on one approach (Lean) and integrate it in the organisation to its full extent. Another cause for thought was brought up by Bevan et al. (2005), who described the NHS experience with Lean Six Sigma. Before Six Sigma was introduced in the NHS, a pilot programme was launched throughout the country to assess the eligibility of using Six Sigma. After obtaining a mean sigma score of 2.0 and a median sigma Score of 1.9 (meaning clinical processes were defective over 30% of the time), they concluded that Six Sigma was unlikely to systematically improve clinical processes in order to increase the sigma core. It was suggested that the basic processes (Lean) be redesigned before embarking on a Six Sigma journey.

Despite these critical views Lean Six Sigma has proven itself in numerous industries. Its use in healthcare is still in an infant stage; hence it is necessary to consider all critical opinions and cases in order to prevent major mistakes from happening. Some critical views are based on facts which can be overturned and worked upon, whereas other views are based on personal preferences, such as Black's (2008) view on Six Sigma.

2.6 Change - Issues that Inhibit Sustainability in Healthcare

The nature of healthcare organisations is that of complex systems involving a wide range of participants (stakeholders) with different needs, priorities and evaluation criteria. At the core of each healthcare organisation are the clinical processes. Hospitals are at the centre of healthcare delivery systems and have to consider input from every stakeholder, making any kind of change difficult and time-consuming (Kanji and Moura E Sa 2003). Furthermore, complexity influences and challenges the definition and creation of performance measurements, goals and vision. Figure 2.6 illustrates potential key stakeholders of a typical healthcare organisation.

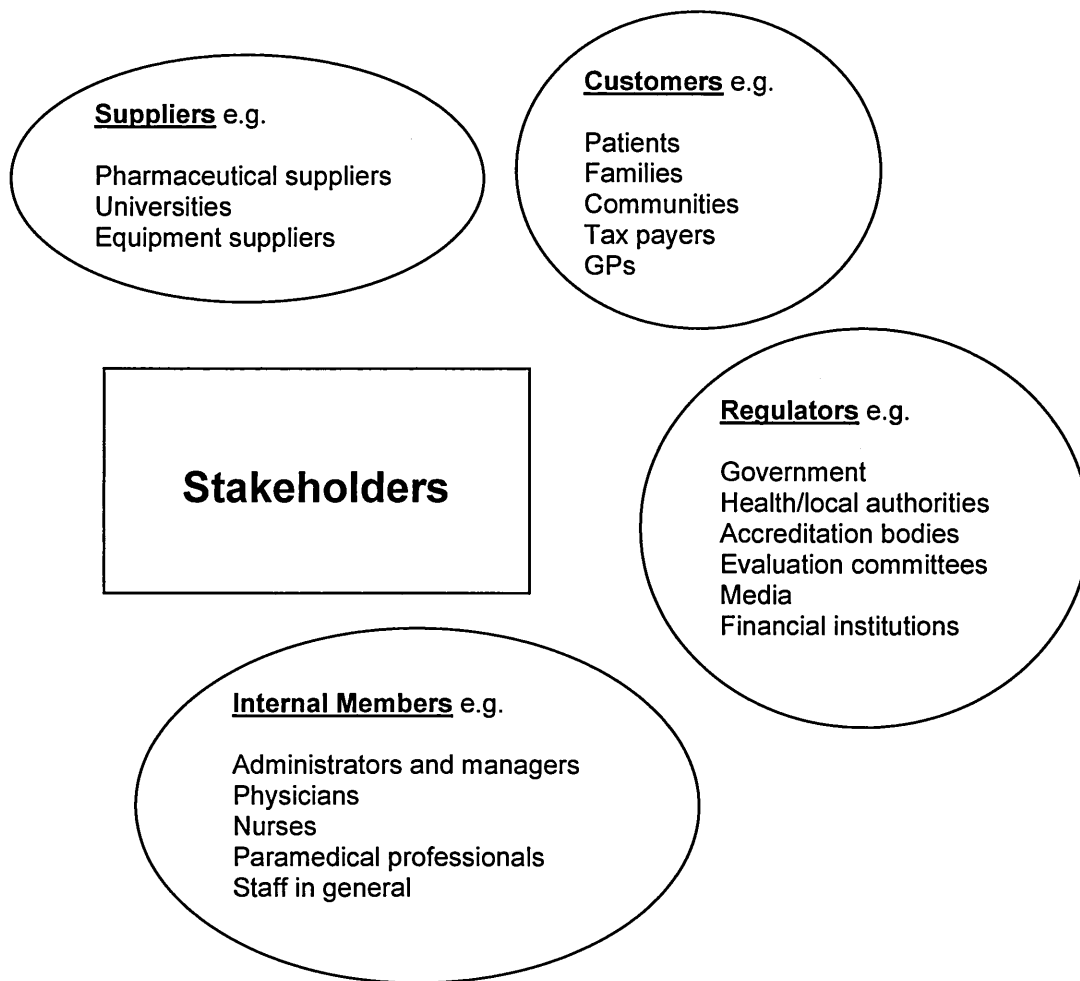


Figure 2.6: Typical healthcare stakeholders
(adapted from Kanji and Moura E Sa 2003)

The complex net of relationship between stakeholders is a clear inhibitor to sustainability, and unless all stakeholders agree and can handle Lean Six Sigma, the integration will be unlikely. The stakeholder issue can be followed back for generations and there is no sure formula in sight. What remains is for the organisation to continuously improve their relationship with stakeholders and seek common ground to reduce the occurrence of opposing interests (Kanji and Moura E Sa 2003).

Other inhibitors to sustaining a process improvement approach exist and can be addressed more easily than the complex relationships between stakeholders in healthcare.

A common inhibitor that has been reported by several researchers and professionals is the introduction of the latest approach (Abrahamson 2000, Fillingham 2007, Naeslund 2008, Vest and Gamm 2009). Abrahamson (2000) discovered that many organisations try to achieve competitive advantage by introducing the latest approach. He further argued that organisations tend to choose the latest approach, as the cost of adopting the approach and gaining short wins may be lower than a long-term commitment. Additionally, he stated that change causes organisational chaos due to initiative overload and recommends that in order to change successfully organisations should know when to celebrate change and stop changing all the time. Fillingham (2007) referred to this inhibitor as "initiativitis" and reflected on his experience with the NHS. As a result of change, staff became tired of new methodologies and cynical to the level that their motivation dropped faster at the implementation of new approaches. To counter this state, he proposed that top management should "show resilience, consistency and perseverance" (Fillingham 2007, p.241) for the chosen process improvement approach. Finally, Vest and Gamm (2009) linked a number of change failures in US healthcare to staff behaviour regarding different approaches, which were perceived as more passing management fads.

At the core of every change initiative are the people in the organisation. Their abilities and skills to drive and not inhibit change have to be assessed and, if needed, improved. Managerial capacity is often used to describe the level of commitment and leadership skills managers possess. According to Fryer (2006), it is essential in order to encourage and support learning and development of staff. Antony et al. (2007) emphasised that management capacity is important, as it includes commitment of financial resources, a clear strategic deployment plan, a communication plan and the use of a reward system. More specifically, it describes the state of ability management has towards change. Näslund (2008) describes this as management embracing a systems view of organisations, which according to him may require specific training and education, but is needed for successful change efforts.

Another inhibitor in healthcare is the right education and training for systems thinking and the deployment of LSS tools. Antony et al. (2007) argued that hospitals hesitate in deploying Six Sigma as the initial investment in specific Belt training seems huge in comparison to Lean. In addition, Iles and Cranfield's (2004) report on change management skills for NHS professionals illustrated that staff have difficulties embracing theories other than medical-related ones. They are occlusive towards viewing their profession from a business perspective, as the psychology of the healthcare workforce differs from other industries. For instance, the use of business and statistical language is difficult for staff to use on a daily basis, and therefore is rejected, which makes sustaining LSS a difficult endeavour. (Antony et al. 2007, Proudlove, Moxham and Boaden 2008).

Furthermore, literature repeatedly reports missing data in healthcare resulting in performance measurements with weak reliability. Antony et al. (2007) reported that healthcare has a lot of data available, but with questionable accuracy, lack in completeness and missing links to hospital strategy and vision. Furthermore, Kanji (2008) concluded that this type of inadequate measurements eventually causes the failure of LSS projects.

2.7 Change - Different Approaches

Change has been defined in a variety of ways in the literature. A common explanation for change was delivered by Van den Ven and Poole (1995), who described the change process as “sustaining momentum”. It is a considerable challenge for organisations to sustain momentum, as many factors have to be considered. Therefore, researchers have defined sustainable organisations as ones dependent upon the institutionalisation of sustainability beliefs and processes (Kotter 1995, Senge and Carstedt 2001).

The awareness of the importance of institutionalising sustainable beliefs and processes is not new and was addressed by Lewin in 1951 (Baulcomb 2003, Kritsonis 2005). Lewin's (1951) three-stage process model was among the first published and most cited model of planned change. The first stage is to

unfreeze the existing status quo in order to overcome resistance and employee complacency. The second stage is referred to as *movement*. In this stage the organisation moves away from the status quo towards the desired state. The last stage is *refreezing*, which takes place subsequent to the change implementation and supports the change to be sustained. Lewin's model is based on the fact that there are forces working in opposing directions. Driving forces facilitate change, as they push employees to commit in the desired direction. On the other hand, restraining forces (resistance) hinder change, as they pull employees away from the desired direction. Lewin therefore emphasised the need to analyse these forces and provided the force field analysis method. The analysis includes brainstorm sessions wherein key employees come up with a list of both forces, evaluate, review and strategise to strengthen the driving forces. This is perceived as an essential step for undertaking a planned change.

Since the development of Lewin's model, many researchers have built upon his results. In 1958, Lippitt, Watson and Westley extended his model and created a seven-step model focused less on the evolution of change and more on the role and responsibilities of change agents (employees driving change) (Kritsonis 2005). In 1992, Schein improved Lewin's model further by adding more psychological insight for each phase, as did Goodstein and Burke three years later. Nevertheless, Lewin's model was criticised of being too simple and not offering practical information for carrying out change in practice (Kanter, Stein and Jick 1992).

Kotter (1995) provided a practical solution to Lewin's model and presented an eight-step roadmap. Each step was validated by over a hundred cases in different industry sectors, and is one of the most popular change models. He discovered that companies fail to change if they disregard one or more of the following eight points:

1 - Establishing a sense of urgency	Making sure that everyone knows that change is important for survival and cannot be neglected. He proposes that leaders take bold and risky actions in order to highlight the importance of change.
2 - Forming a powerful guiding coalition	This includes top management and senior managers. The more powerful the team the higher the chances for a successful change. A powerful team is represented by employees who sit in important positions, therefore being able to overcome barriers more easily.
3 - Creating a vision	A vision which clarifies the general direction for change is well-constructed and motivates employees. He further argues that a good vision has to be concise and linked to goals.
4 - Communicating the vision	This refers to the communication stream in organisations. A well-defined vision will not generate the expected benefits if it is not known by everyone in the organisation. He also states that simply passing on the message will not suffice. Management should rather engage with staff in discussions and dialogues about the vision and keep the message simple and clear.
5 - Empowering others to act on the vision	In order to empower employees to act on the vision, the working environment should make it possible. This step focuses on getting rid of obstacles to change and changing structures in the organisation that undermine the vision. Furthermore, employees are encouraged to work pro-actively by taking risks and pursuing non-traditional ideas or actions.
6 - Planning for and creating short-term wins	In order to support sustainability Kotter proposes to look for and create short-term wins. They will motivate employees to further commit to activities as they see that their efforts get rewarded. However, he warns that these short-term wins should not be seen as the end of the change initiative but rather as way to motivate employees. Short-term wins project usually take some months (not longer than 6 months) and should be celebrated.
7 - Consolidating improvements and producing still more change	This step ensures that complacency does not occur, as it is one of the most reported pitfalls when generating short-term wins. It is important that organisations see an end to a project and reflect on what has happened. Kotter emphasises that this step is necessary to keep up the momentum, as the consolidation of improvements will motivate the employees to seek further change possibilities.
8 - Institutionalising new approaches	This step directly refers to the concept of sustainability. It exists to ensure that the new ways of operating are firmly grounded in the organisations' culture.

Table 2.4: Kotter's Eight Steps to Transforming an Organisation

The different approaches to change from Lewin to Kotter have in common that they are based on *planned change*. A characteristic of planned change is that resistance towards the initiative has to be drastically reduced prior to implementing the change. Hence, organisations choosing this route spent time

on increasing the driving forces and reducing the resistance forces, which is seen as mandatory for any pre-change implementation. However, Strebel (1994) realised that organisations can also successfully change where the forces of change are weak (resistance is higher than or equal to driving forces). He proposed eight paths an organisation can take when wanting to change. The choice of which path to take depends on a series of questions relating to the forces of change (Figure 2.7).

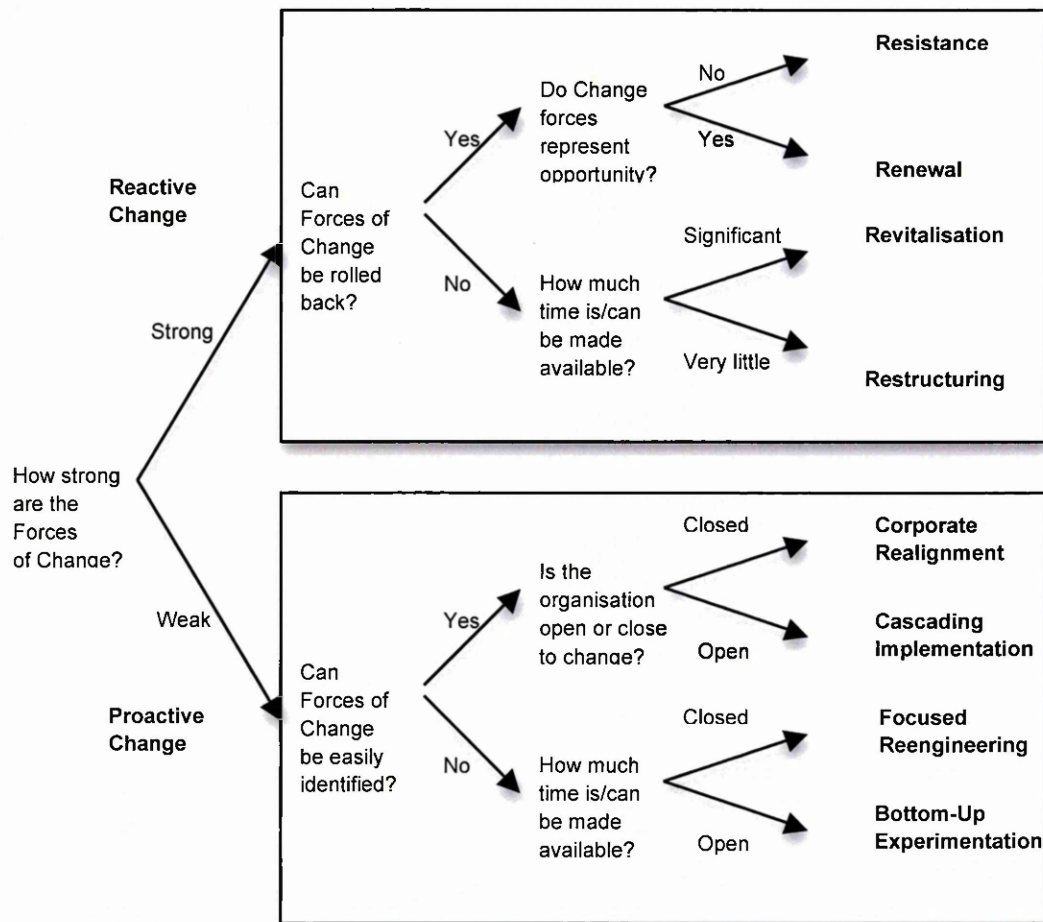


Figure 2.7: Strebel's Change Path (derived from Strebel 1994)

Strebel distinguished between reactive and proactive change. Depending on how strong the forces of change are, the organisation will follow one of both change paths. In case the forces of change are strong, the organisation would be located on the reactive path. He further stated that the majority of organisations follow a reactive change path, as external or internal factors drive them to change (e.g. political pressure, market pressure etc.). On the other

hand, a proactive change represents a situation whereby an organisation is doing well but seeks to improve to do better. This change path is difficult to realise for managers, as there is no obvious need for change, meaning that it needs to be created. Strebel argued that whether an organisation has strong or weak force of change does not dictate whether it can successfully change or not. It rather provides the organisation with insight on how to approach the change initiative (Strebel 1994).

Many approaches have in common that they build on factors that have been theoretically and empirically proven to be critical for successful change. Kotter's eight steps represent an amalgamation of such factors. Another framework presented by Golden (2006) is built on factors such as goals definition, top management support, communication and rewarding improvement. Golden explained that frameworks focusing on changing organisations are complementary with the key work from Lewin or Ambrose. In 1987, Ambrose created a framework that focused on factors that were critical and their implication on the outcome of the change initiative.

	Skills	Incentive	Resources	Action Plan	= Confusion
Vision		Incentive	Resources	Action Plan	= Anxiety
Vision	Skills		Resources	Action Plan	= Gradual Change
Vision	Skills	Incentive		Action Plan	= Frustration
Vision	Skills	Incentive	Resources		= False Start
Vision	Skills	Incentive	Resources	Action Plan	= Change

Table 2.5: Ambrose's recipe for successful change

This framework best describes how important each factor is for a successful outcome. By ignoring a factor, successful change will not take place (like with many other frameworks) and staff will for example face situations of confusion or frustration. These important factors are referred to as critical success factors (CSF) and are explained in the section 2.8.

Considering the above mentioned change management theories and different frameworks, hospitals have gained their share of experience following and adapting the frameworks. Beside the cases of RBH and VMMC (presented in this chapter) other hospitals have attempted to sustain change. For instance,

according to Hellström, Lifvergren and Quist (2010) the Swedish Skaraborg Hospital Group (SkaS) has been involved in fundamental change to their whole system. Since 2005, 45 Black Belts and 200 Green Belts have been trained using DMAIC as their methodology. The hospital realised the importance of well-trained staff and conducted a thorough training system resulting in over 3000 trained white belts. This allowed reducing resistance towards change, as more non-decision makers were educated in the principles of process improvement. However, SkaS has not managed to sustain their changes due to organisational complexity. In cross-departmental projects Project Managers are not being held accountable for projects failing as the hospital still emphasises a functional view rather than a process view. This means that the fault is sought at the different departments. In addition, the organisational complexity of hospitals has contributed to SkaS inability to sustain change, as they have been unable to manage the group (doctors and nurses) responding to professional requirements and those seeking fiscal controls (managers and trustees). Hence, the goals defined often contradict each other as they represent different views. This makes accountability difficult.

Another case is Floyd Medical Center (FMC) in the U.S. (Stuenkel and Faulkner 2009). The hospital followed a structured 120 day change model which was an iterative process and aimed to bring consistency in the change process. Every 30, 60 and 90 days participants were to attend a group meeting (check-In) where their progress in the change project would be discussed. At the end of the project the results would be presented and further steps discussed. Every participant was responsible for finding waste along the process and finding a way to eliminate it. In addition the 120 day model allowed staff to independently work on improvement and discuss problems at the check-ins. By involving every employee FMC managed to obtain high motivation and forces to change without risking a halt in improvement projects as once the 120 days were over another 120 day project would start. Furthermore, every 120-day cycle introduced a new tool allowing staff to learn about its usage in a practical way. Alone in the first 120 day cycle 288 changes were instituted.

2.8 Critical Success Factors

The definition of critical success factors (CSFs) varies throughout the literature in terms of terminology used. The term was first popularised in 1979 by Rockart, who came up with the idea of identifying and using CSFs as important groundwork for managers' information needs. Powell, Rushmer and Davies (2009) used the terminology "core conditions for successful implementation" instead of CSF to explain factors critical to success. They further stated that the factors are necessary but insufficient for a successful implementation of quality improvement initiatives. Bateman and Rich (2003) on the other hand considered CSF synonymous with "enablers of process improvement activities".

Broad agreement has been reached between academics on the usability of CSFs. Antony et al. (2007, p.249) defined CSFs as the "essential ingredient without which the initiative stands little chance of success". He further stated that "each one must receive constant and careful attention from management as these are the areas that must 'go right' for the organisation to flourish. If results in these areas are not adequate then the efforts of the organisation will be less than desired".

CSFs must be accomplished by the organisation in order to achieve its mission. Kanji, Makek and Tambi (1999) agreed that CSFs are the minimum key factors that have to go well to ensure success for the organisation.

Despite the differences of CSFs in origin or in emphasis, they have in common that they all require a similar broad set of conditions to be met, as they represent those areas in management that must be given special and continual attention to cause high performance (Powell, Rushmer and Davies 2009).

This research considers CSFs for the integration of Lean Six Sigma. The following CSFs illustrate that they are not constrained by geographical or industrial factors.

Jeyaraman and Kee Teo (2010) conducted a pilot study in Malaysia to assess CSFs in the electronic manufacturing service industry. Input from 23 LSS specialists was obtained and enabled identification of the following ten CSFs:

- Management engagement and commitment
- Reward and recognition system
- Competency of MBB and BB
- Company financial capability
- Frequent communication and assessment on LSS results
- Project prioritisation, selection, review and tracking
- Project success stories, best practices sharing and benchmarking
- Effective LSS training program
- Established LSS dashboard
- Organisational belief and culture.

Antony et al. (2007) identified six CSFs for Six Sigma deployment in the NHS (in the context of UK healthcare).

- Uncompromising top management support and commitment
- Formation of Six Sigma infrastructure and the appropriate training
- Project selection and the associated financial returns to the bottom-line
- Effective communication at all levels
- Developing organisational readiness
- Effective leadership.

On the other hand, Sears (2009) identified a set of 7 CSFs for Lean Six Sigma integration in Bon Secures Health System (in the context of USA healthcare).

- Create sense of urgency
- Align efforts throughout the system
- Provide nimble, decision-oriented change leadership and accountability
- Develop competencies and provide expertise that support decision making and project execution

- Employ improvement processes, methodologies and tools that enable swift change and high quality solutions
- Efficiently and rapidly transfer learning to all parts of organisation
- Empower employees with freedom and resources to do their job within a clearly defined and aligned organisational framework of governance and accountability.

The above-mentioned CSFs were obtained in different industries (e.g. healthcare and manufacturing) and different locations (e.g. Malaysia, the UK and the USA), yet it becomes clear that the CSFs do not significantly differ.

Several studies identified CSFs which, according to Powell, Rushmer and Davies (2009), are at their cores similar, but different in level of detail. For example, “efficiently and rapidly transfer learning to all parts of the Organisation” (Sears 2009), “effective communication at all levels” (Antony et al. 2007) and “frequent communication and assessment on LSS” (Jeyaraman and Kee Teo 2010) could be categorised under *communication at all levels*.

The level of detail not only differs between studies but also within studies: “Frequent communication and assessment on LSS results”; “Project success stories, best practices sharing and benchmarking” and “established LSS dashboard” (Jeyaraman and Kee Teo 2010) are parts of a well-established communication system. Establishing LSS dashboard is a communication tool to keep improvement on track, and sharing success stories and best practices is a way of communication to motivate employees and compare performance. These three factors all aim to contribute to the communication and therefore can be categorised under the topic communication at all levels.

2.9 Rationale for Research

In the UK, the NHS encompasses several inter-linked healthcare systems, such as primary care, in-patient/out-patient care at hospitals, community care and some elements of social care. Among these various systems, in-patient/out-patient care at hospitals is considered to be the major bottleneck in the NHS

(Jones and Filochowski 2006, Mathieson 2006). Consequently, hospital-based systems have been the subject of many research studies whereby efforts have been made to improve the performance of hospital operations. Common process improvement approaches in healthcare included improving emergency department throughput (Kelly et al. 2007, Ben-Tovim et al. 2008, Dickson et al. 2009), operating room throughput (Van den Heuvel et al. 2006, Fairbanks 2007, Bisgaard and Does 2009), reducing patient waiting times (Bush et al. 2007, Ben-Tovim et al. 2008) and reducing medication errors (Natarajan 2006, Fillingham 2007, Chassin 2008).

It is evident that previous literature has overemphasised the implementation part of LSS and neglected the long-term impact of LSS on healthcare. In fact, Näslund (2008) reported from organisations approaching change from only three ways: functional, operational and ad hoc, neglecting a holistic or systemic analysis. He concluded that the literature has not provided a systemic approach to change and improvement, which also includes the assessment of readiness for change. There is undoubtedly a need to sustain process improvement approaches.

A recent article by Kumar, Antony and Tiwari (2011) highlighted the need for a structured framework that supports the integration of Lean Six Sigma in organisations. Their analysis of existing frameworks came up with less than a handful of frameworks that actually incorporate a structured step-by-step approach to implement process improvement approaches. Out of these frameworks, all lack the link to the strategic needs of an organisation, meaning that these frameworks do not link the initiatives to the organisations' vision and goal statements, or fail to link the initiative to measurable objectives. To this day, the non-existence of frameworks focusing on sustaining Lean Six Sigma in healthcare, the evidence provided by the literature and discussions with LSS experts strengthens the need for this research.

2.10 Conclusion

This chapter provided information about the utilisation of Lean Six Sigma in healthcare and underlined the need for a structured framework to sustain Lean Six Sigma. It presented the differences between the healthcare and manufacturing industries and further introduced Lean and Six Sigma individually and provided information for cases in both disciplines conducted in healthcare. The high amount of Lean literature compared to Six Sigma is notable. Regarding the healthcare industry, more Lean-based cases are available than Six Sigma cases. This is further underlined in the presentation of Lean Six Sigma cases in Section 2.5. Many hospitals are either afraid or do not feel ready yet for an extensive implementation of Six Sigma.

Furthermore, the chapter highlighted the need for a sustainable view on Lean Six Sigma, as there are no cases and frameworks of such a magnitude. To address this issue, Sections 2.6 and 2.7 provided information about inhibitors to sustainability and approaches to change. Built on that information, the terminology "critical success factor" was identified and explained in 2.8. To conclude, the rationale for this research was provided stating the need for a sustainable LSS framework.

In sum, the following research gaps were discovered from the literature review:

- There is no framework available to support healthcare professionals with the integration of Lean Six Sigma in their organisation.
- Cases addressing the sustainability issue *in healthcare* focus on Lean and do not provide approaches on how to address CSFs.

This research will provide a framework to support healthcare professionals to sustain Lean Six Sigma and address each CSF in order enhance a beginner friendly use of the framework.

CHAPTER 3:

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The main purpose of this chapter is to provide an outline of the research methods used and to explain the procedures employed to collect the data. The prior chapter presented the facts necessary for this research work. It revealed gaps in research that call for the development of a sustainable Lean Six Sigma framework.

This chapter begins by introducing the research design and methodology. The underlying theory behind the purpose, approach and strategy of research and the available data collection methods are explained. Section 3.3 gives a short summary on how this research is designed, and finally the chapter concludes with Section 3.4, providing a detailed view on all methods used in this research.

3.2 Research Design and Methodology

Research design is often described as the 'blueprint' that enables researchers to find a way to solve possible problems (Yin 2003). In addition, research design guides the researcher in the process of collecting, analysing, and interpreting research observations (Nachmias and Nachmias 1996). Correspondingly, it deals with at least four problems of carrying out successful research: what questions to study, what data are relevant, what data should be collected and how results should be analysed (Yin 2003). Research design also covers the choice of data collection methods and tactical decisions regarding measurement and scaling procedures, samples in questionnaire and analysis of the data (Zikmund 2003).

In contrast, research methodology is a set of procedures and rules to guide research (Robson 2002). Research methodology should include sampling design, data collection, data analysis, and limitations or constraints of the research. The right research methodology depends on criteria such as the type of information needed, the character of respondents, aim of the study, and

constraints of time and money (Saunders, Lewis and Thornhill 2009). The choice of a methodology does not follow a strict wrong or right path, but the researcher should choose the most appropriate and beneficial method for the research needs (Turabian 2007).

In sum, research design provides a conceptual framework for the study, while research methodology is concerned with tools that are necessary to achieve each specific aim.

3.2.1 Research purpose

The role of research is to fill a gap where information and data have been extensively collected in order to create something new and contribute to the body of knowledge (Phillips and Pugh 2000). Experts and authors in social research agree on the following purposes of carrying out research: exploratory, descriptive and explanatory (Robson 2002, Collis and Hussey 2003, Yin 2003, Yates 2004).

Exploratory research focuses on building descriptions of complex circumstances or phenomena, which are not or are poorly explained in the literature. According to Saunders, Lewis and Thornhill (2009), exploratory studies often start with a wide research area, and narrow down as the research develops. Exploratory research usually addresses the "what" question. Neuman (2004) explained that exploratory research is characterised by defining problems more precisely, clarifying the concepts, gaining insight, eliminating impractical ideas, and forming hypotheses, but not necessarily testing them. Data-gathering involves either qualitative or quantitative strategies, or a combination of both. Commonly used approaches are personal interviews, focus-group interview sessions and survey with small sample size (McNabb 2008).

Descriptive research presents a picture of specific phenomena. According to McNabb (2008), descriptive studies typically involve large samples which describe an event or define a set of attitudes or opinions that are observed or measured. Time is of great importance as the "picture of the sample" varies if

the research is repeated after some time. Therefore, descriptive studies are divided into either cross-sectional or longitudinal studies. Cross-sectional refers to a "one-shot" assessment of a sample of respondents, and longitudinal studies refer to studies that assess the same sample over two or more time intervals. Descriptive research usually addresses the "how" and "who" question. Common approaches used are face-to-face interviews, telephone or email interviewing and field surveys.

Explanatory research tends to go beyond exploratory and descriptive research to identify the actual reasons a phenomenon occurs. It aims at providing explanations of events in order to identify causes opposed to simply describing the phenomena (Marlow and Boone 2010). It is important to note that conducting an explanatory research requires a well-defined research problem that needs to be stated. Additionally, explanatory research is used within areas where extensive research has already been done (Yates 2004). Explanatory research usually addresses the "why" question. Approaches used are often derived from secondary data, such as literature survey or discussions and cases.

The current research sets out to answer "why" LSS has not been sustained throughout healthcare, despite LSS being known to healthcare since the beginning of the century. Chapter 2 presented what issues organisations are facing when wanting to sustain process improvement approaches. Based on chapter 2 and the results of chapter 4 and 5 a solution is proposed on how to address this issue and successfully sustain LSS in a healthcare organisation.

3.2.2 Research approach

A critical phase in research is the selection of the research approach when seeking answers to a problem. According to Creswell (2003), gaining more knowledge about research approaches is critical as it helps the researcher to take more informed decisions about the chosen research design.

Various research approaches are discussed in the following sections as this research made use of multiple approaches.

3.2.2.1 Empirical versus theoretical

According to Sumser (2001), social research encompasses two major elements: empirical and theoretical. In empirical research, the researcher gains knowledge by means of direct observation or experience. In contrast, theoretical research is based on existing literature. The aim is to benefit from ideas described in the literature and use them to generate a new or different view of the situation that will also contribute to knowledge.

Remenyi et al. (1998) pointed out that empirical research is dominant in business and management research. They further stated that a theoretical framework is essential for doing any empirical study, even when the approach of each researcher differs. Additionally, they believed that it is impossible to use empirical research if a theoretical background related to the subject under study has not been gathered. The results of empirical research can be obtained and analysed quantitatively or qualitatively.

3.2.2.2 Inductive versus deductive

The two types of research approaches described below are often referred to as "research-then-theory" and "theory-then-research", respectively inductive and deductive research. Babbie (2010) explained that Inductive research starts with specific data being used to develop an explanation to account for the data. This data can be derived from observations following a thorough search for patterns. Deductive research on the other hand relies on theory (literature) as a foundation for the new research. Based on the theory, hypotheses are derived which are then tested through observations. Deductive research can be explained as a top-down approach that works from the more general to the more specific. Conversely, inductive research has a bottom-up approach, meaning that it works from specific observations to broader generalisations and theories.

3.2.2.3 Qualitative versus quantitative

The two most common methodological approaches are qualitative and quantitative approach (Creswell 2003, Yates 2004, Saunders, Lewis and Thornhill 2009). A simplistic way of distinguishing between qualitative and quantitative approaches is that the former focuses on describing characteristics of people and events rather than comparing them in terms of measurements or amounts, whereas the latter focuses attention on measurements and quantifiable characteristics of people and events. A qualitative approach usually aims to obtain richness of detail rather than statistical generalisations, and therefore is often small-scale. The goal is to aim for detailed description and understanding of the phenomenon under investigation, for example by observation (Thomas, 2003). Additionally, qualitative approaches involve "the studied use and collection of a variety of empirical materials – case study, personal experience, introspection, life story, interview, artefacts and cultural texts and productions, along with observational, historical, interactional and visual texts – that describe routine and problematic moments and meanings in individuals' lives" (Denzin & Lincoln 2011, p.4). Qualitative methods are criticised regarding their subjectivity and lack of rigorous experimental control and determinism. Yates (2004) argued that these characteristics limit the application of qualitative methods to certain types of research. The quantitative approach focuses on statistical generalisation of findings that seek explanation and prediction of events by searching for regularities and causal relationships between independent and dependent variables (Yates 2004). A major weakness of quantitative methods is that it is not possible to go in-depth in every area at the same time, since it is standardised, therefore not giving any room for interpretations and new angles (Robson 2002).

As described above, there are differences between the qualitative and quantitative approaches. Nevertheless, according to Thomas (2003), a qualitative approach can be used as a planning tool for a subsequent quantitative approach. In order to find out the "how", "why" and "what" of a topic, the two approaches can be often used in conjunction with one another as complementary approaches.

3.2.3 Research strategy

Research strategy is a general plan of how the researcher will go about answering the research questions (Saunders, Lewis and Thornhill 2009). It is concerned with determining the relevant approach to use (e.g. whether to use a survey or to carry out an experiment, undertake action research or another appropriate process). The research strategy aims to answer the question "what type of research is appropriate". Robson (2002) distinguished between three main strategies: experiments, surveys and case studies. Experiments measure the effects of manipulating variable X on another variable Y. Although it features strongly in some social science research such as psychology, it is more related to the natural sciences. Surveys collect information in standardised forms from groups of participants. Surveys are usually associated with a deductive approach (Robson 2002). On the other hand, case studies develop intensive and detailed knowledge about a single case (or a small number of related cases). Case studies are usually appropriate for exploratory work (Yin 2003).

Surveys are a popular and common strategy in management and business research (Saunders, Lewis and Thornhill 2009). Surveys have the advantage of being highly economically while still allowing the collection of a huge amount of data from a sizeable population. The data obtained are standardised and allow for easy comparison. Surveys have two main purposes: describing a population and/or "testing an hypothesis about a relationship that is expected to exist within a population" (Leon et al. 2003). Surveys also come along with a number of disadvantages. The participants' characteristics, such as memory, knowledge, experience, motivation, and personality affect the collected information in one way or another (Neuman 2004). Also, the participants may be influenced to not accurately reflect their beliefs and attitudes (Robson 2002). Finally, the representativeness may be jeopardised by receiving a low response rate (Saunders, Lewis and Thornhill 2009).

Case studies are more suitable for doing research to investigate a phenomenon within its real context (Robson 2002). According to Saunders, Lewis and Thornhill (2009), case studies can be a very valuable way of exploring existing

theory. They provide a source for the development of new hypotheses, and challenge existing theory. Researchers question the ability to generalise from a single case (Robson 2002). Additionally, case studies have been criticised for taking too long, and resulting in long, unreadable documents (Yin 2003).

This research makes use of a thorough literature review, a survey and the input of Lean Six Sigma specialists in the data gathering and validation part.

3.2.4 Data collection methods

The research purpose, approach and strategy were determined in the prior sections, and it is now necessary to decide how the data will be collected. Appropriate methods have to be chosen from the variety of data collection methods. There is no limit to how many methods can be chosen if they directly benefit the research undertaken.

Before deciding which data collection method is the most appropriate for this research, it is vital to distinguish between two main types of data: secondary and primary. The following two sections provide a brief discussion of the primary and the secondary methods to be considered in designing a research study.

3.2.4.1 Secondary data

Secondary data is the analysis of data that was either gathered by someone else or "for some other purpose than the one currently being considered, or often a combination of the two" (McCaston 2005). Secondary data do not require access to respondents or subjects, as the data has already been gathered and analysed, they therefore provide a cost-effective and time saving way of gaining a good understanding of the research questions. Sources of secondary data are government and academic publications, public databases and the Internet. The use of secondary data provides necessary background information and builds credibility for the research. Additionally, if the secondary data is specific, comprehensive and valid, it can provide a solution to the

research problem and an alternative to primary data research methods (Remenyi et al. 1998).

Furthermore, secondary data can be classified into three categories (Saunders, Lewis and Thornhill 2009):

- Documentary secondary data - includes written documents (reports, minutes, books or journals) and unwritten documents (films, pictures, or drawings).
- Survey-based secondary data - data which has been gathered and analysed by other researchers.
- Multiple-source secondary data - a combination of documentary and survey-based secondary data.

As with all methods, disadvantages and advantages go hand in hand. In addition to some of the advantages of secondary data as a data collection method, which have already been described, secondary data inform and complement primary data collection in a way that saves time and resources associated with over-collecting primary data. The disadvantages are that secondary data are not designed especially to meet the researcher's need. Therefore, the researcher must test secondary data for accuracy, bias and soundness (McCasten 2005), as they have a lack of availability and relevance, and are inaccurate and insufficient on their own.

3.2.4.2 Primary data

Primary data are data collected directly from a subject with a specific purpose in mind. The researcher has to follow a set of specific rules to collect the data. Primary data are considered reliable because the data are collected for a specific purpose, however they do have limitations. It is time consuming to collect data and the quality of data is questionable, as it depends on many factors, like the language used not being consistent or subjects answering dishonestly etc. (Houser 2007).

In the following sections, several data collection methods are discussed and evaluated for applicability to this research.

3.2.4.2.1 Focus groups

Focus groups are used to collect data on the feelings and opinions of a group of people who are involved in a common situation. The group is led by a group leader who stimulates the group to discuss about their opinions, reactions and feeling about the research topic (e.g. a product, service or concept). Focus groups are a combination of interviews and observations; moreover they are often used in pilot studies to develop a questionnaire. They are often used in market research or in polling political opinions, as they provide rich data (Yates 2004). Focus groups are a data collection method which generates qualitative data, and therefore need to be analysed in a qualitative manner (e.g. coding) (Collis and Hussey 2003).

Focus groups were not considered for this research, as the benefit gained from it does not outweigh the effort of getting a group together with knowledge in the healthcare industry and Lean Six Sigma.

3.2.4.2.2 Interviews

Interviews are used to ask subjects questions "in order to find out what they do, think or feel. Interviews make it easy to compare answers and may be face-to-face, voice-to-voice or screen-to-screen; conducted with individuals or a group of individuals" (Collis and Hussey 2003, pp.167-168). The interviews can be structured (standardised questions for all), semi-structured (non-standardised questions, however with a list of topics to be covered), or unstructured (informal conversation).

The types of interviews have different purposes. Structured interviews are often used to collect data and analyse them in a quantitative manner. On the other hand, the outcome of semi-structured and unstructured interviews has a high variability, changing from one interview to the next. This high variability is often considered the strength of such research (Collis and Hussey 2003). These

interview types are frequently used in qualitative research. The advantages are flexibility, high response rate and the inference of contextual meaning from paralinguistic features (e.g. communication by body language), which in addition to verbal communication can clarify the questions and answers of the interview. Disadvantages are the costly nature of interviews (travel expenses), time consumption, lack of anonymity and interviewer bias (Collis and Hussey 2003).

This research made use of the semi-structured interview method for validation. A small number of subjects participating in the interview was solicited (around five subjects), hence a structured interview would not have been efficient as the data would be too small for a quantitative analysis.

3.2.4.2.3 Questionnaires

The components of a questionnaire are structured questions that have been carefully chosen after considerable testing. The aim is to achieve reliable responses from a chosen sample by finding out what the participants do, think or feel. The characteristics of the questions can be either qualitative (open-ended questions) or quantitative (closed questions). The questionnaire response data can be computer processed for ease of analysis. The magnitude of questionnaires ranges from large-scale to small-scale surveys, and also depends on the characteristics of questions chosen. Large-scale surveys are often used in quantitative studies, whereas small-scale studies use more open-ended questions, as the low amount of responses allows specific coding of such questions (Collis and Hussey 2003). Some advantages of using a questionnaire as a data collection method are (Gillham 2000): that it is less time-consuming and cheaper; it is easier to get a large amount of data from a lot of people; analysis of answers to closed questions is straightforward; there is less pressure for an immediate response from respondents (positively influencing data quality); a high level of respondent anonymity is possible; and interviewer bias is reduced. However, the disadvantages of a questionnaire include: low response rate; missing data; over-simple and brief structure and context of questions; respondent dishonesty; and ambiguity of questions (Gillham 2000, Neuman 2004).

Questionnaires were used in order to obtain broad information from a large-scale survey. In addition, this research used questionnaires to obtain specific information on a small-scale from experts by following a specific method.

When using questionnaires, several factors have to be considered:

- the choice of sample size
- the type of questions
- the wording of questions to prevent ambiguous questions
- the design of the questionnaire
- the creation of an accompanying letter
- the method of distribution
- validity and reliability check
- the methods for analysing the data
- what to do if questionnaires are not returned/filled in.

(Fowler 2002, Collis and Hussey 2003).

Choosing a sample size is a fundamental element of a questionnaire. A sample is part of a population. A population can be a body of people or any other entity. For example, a population can be "all British adults in UK"; a sample is part of this population "working in public sector". In order to select an appropriate sample, it is mandatory to set the unit of analysis for the questionnaire. The unit of analysis can be for example an organisation or occupation. If an organisation is chosen as the unit of analysis, just one questionnaire can be sent to each organisation. Furthermore, a good sample is characterised by a random selection in the population, the size necessary to satisfy the needs of the research being undertaken and unbiased selection to guarantee the representativeness of the population (Collis and Hussey 2003).

The most common methods to select a sample are:

- random sampling
- systematic sampling
- stratified sampling.

In random sampling, elements in the population are chosen randomly. A table of random numbers is generated from a computer to guarantee that each element has an equal probability of selection. Systematic sampling arranges the population according to some ordering scheme. The population is divided by the required sample size, resulting in "n". Next, a randomly chosen number (x) between 1 and "n" is selected. The sample is the amount of each "xth" of the population. Finally, stratified sampling relies on a subpopulation (stratum). It divides elements of the population into subgroups before sampling. For example, if the population has two categories, female and male, and the percentages are 75% and 25%, then stratified sampling would ensure that the sample also has the similar proportion of 75% female and 25% male.

A questionnaire can consist of a single type of question or a mix of several types. It is a decision the researcher has to make with regard to his choice of data analysis. A quantitative questionnaire focuses on questions which give back a numerical value, such as closed questions. Closed questions can either have two values ("yes" or "no") or multiple values using rating scale type of questions (Lickert-scale questions). On the other hand, qualitative questionnaires focus on open-ended questions. Open-ended questions have no pre-set value, as the answer varies, therefore leaving the research to analyse the content of the answers (Collis and Hussey 2003).

According to Collis and Hussey (2003), the wording of questions to prevent ambiguous questions can best be tested by piloting the questionnaire. In addition, piloting the questionnaire has a second purpose, which is to validate the questionnaire by using a face validity check.

Designing the questionnaire takes into account the abovementioned points. Additionally, part of this step is to ensure the participant knows what to do (purpose of the questionnaire) and how to do it (context in which the questions are being posed and way of answering the questions). A well-explained instruction is therefore imperative for a well-designed questionnaire (Collis and Hussey 2003).

A letter of explanation accompanying the questionnaire states the purpose of the questionnaire in a more detailed way and the background of the researcher conducting the study. In addition, ethical issues are cleared, such as permission from relevant bodies and steps to safeguard the anonymity of participants and the confidentiality of their answers.

According to Collis and Hussey (2003), the cost of a questionnaire is often considered important when it comes to the choice of distribution method.

- Sending the questionnaire by post is a commonly used method. The questionnaire is posted to the sample, often with a prepaid envelop for returning the completed questionnaire. The response rate can be very low; therefore follow-up questionnaires are often posted.
- Face-to-face interviews consist of questionnaires which are presented to participants in the street, in the home or in the workplace. Advantages are high response rates and the chance to interact with participants by explaining several questions more precisely. Disadvantages are high costs and time consumption.
- Conducting the questionnaire by telephone allows the researcher to have personal contact with the participant with a fraction of the cost associated with face-to-face interviews. This method has a high response rate and follow-up of non-respondents is easily handled.
- Distributing questionnaires over the internet has become increasingly popular in recent years. It has many similarities to postal questionnaires, but also some important differences. Emails can be sent to the sample requesting that prospective participants fill in either the attached questionnaire or visit a webpage where the questionnaire is administered. The advantages of this method are the low cost and high speed of data collection. Additionally, questionnaires distributed online can reach a broader audience, including in other countries, with no extra cost. The biggest disadvantage is the proviso that internet technology be available; in order to participate in online questionnaires, it is necessary that

participants have an unrestricted Internet connection. Consequently the researcher needs to know if his sample has access to internet (Czaja and Blair 2005).

A validity and reliability check is part of using questionnaires. Reliability links with the findings of the research. Findings are reliable if the questionnaire repeatedly delivers the same results. Validity, on the other hand, is concerned with whether the data collected accurately represents what is being studied. Results from the questionnaire are worthless if they deliver high reliability but are not valid; therefore the relationship is that reliability is necessary but not solely sufficient for validity.

The methods for analysing data differ according to whether the questionnaire is created to receive quantitative or qualitative results. Quantitative data analysis relies on either descriptive or inferential statistics, or a combination of both. Statistics software (e.g. Matlab and SPSS) or spreadsheet programs (e.g. Excel) are used to conduct the analysis of quantitative data. In contrast, qualitative data analysis does not have a clear and accepted set of rules for analysis. Some common methods of data analysis are content analysis, repertory grid technique or grounded theory.

The final decision to make when considering the use of questionnaires is what to do if questionnaires are not returned or filled out. In a few cases the researcher is already satisfied with the responses received. Normally reminders in the form of a short email or telephone call are used to get participants to fill out the questionnaire. Additionally, it is crucial to differ between questionnaire non-response and item non-response. The latter refers to questionnaires not being completely filled out, which may bias the data, rendering it unrepresentative of the entire population (Collis and Hussey 2003). Questionnaires presented on a webpage can prevent questions from not being filled out by not allowing the participant to proceed with the questionnaire.

3.3 Summary of Methods Used in This Study

Lean Six Sigma is a management philosophy which has been used for many years in the manufacturing industry and has received attention in the service industry. Cases of using Lean Six Sigma in healthcare go back as far as ten years. However, recently a high percentage of literature has been published specifying each element of Lean Six Sigma and its relationship and influence on organisations. This research is explanatory in nature, as research on Lean Six Sigma and transformation of organisations exists. Respectively, this research sets out to answer “why Lean Six Sigma is not sustained in healthcare” and “how it can be sustained”. Furthermore, this research study encompasses both empirical and a theoretical research approaches. It makes use of both extensive literature survey and quantitative and qualitative methods by using a deductive and inductive (Interpretive Structural Modelling) approach. Questionnaires and Interview are the dominant data collection method in this research. Advantages and disadvantages of questionnaire have been extensively analysed in the preceding sections of this chapter. The questionnaire method was chosen because it is cheap and less time-consuming. Additionally, as the researcher wanted the data to have a good level of generalizability, the questionnaire method with distribution via email and webpage was chosen, as it is easy to reach participants in other countries.

Due to the time constraints imposed by a three-year PhD programme, case studies as research strategy were not considered. This research focuses on embedding a sustainable Lean Six Sigma in healthcare organisations. A transformation of the organisational culture is imperative to accomplish the integration of Lean Six Sigma in the organisation. The transformation of an organisation, according to Kotter (1995), takes at least 5 to 10 years. Furthermore, there are no cases of healthcare organisation transformation that look at a timescale of more than two years. So far, sophisticated cases are content with obtaining snap-shot information over a year to two years in order to conclude sustainability (Glasgow, Scott-Caziewell and Kaboli 2010). This research does not partake in providing a case study, as the literature material

(including secondary cases) suffices in combination with empirical methods such as a survey strategy.

3.4 Design of This Research

This research made use of a thorough literature review, a survey, the input of Lean Six Sigma specialists and an evaluation questionnaire.

3.4.1 Literature Review

According to Dawidowicz (2010), a "literature review is a systematic examination of knowledge available on a topic". The researcher will gain ideas and background of the field being studied during review of literature. This study is interdisciplinary and includes literature from operations management and change management, with a major focus on healthcare-related literature. With regard to that, the researcher begins by reviewing comprehensive related literature in both fields. The study has covered many references, including: academic papers, reports, white papers, theses and dissertations, professional magazines and books.

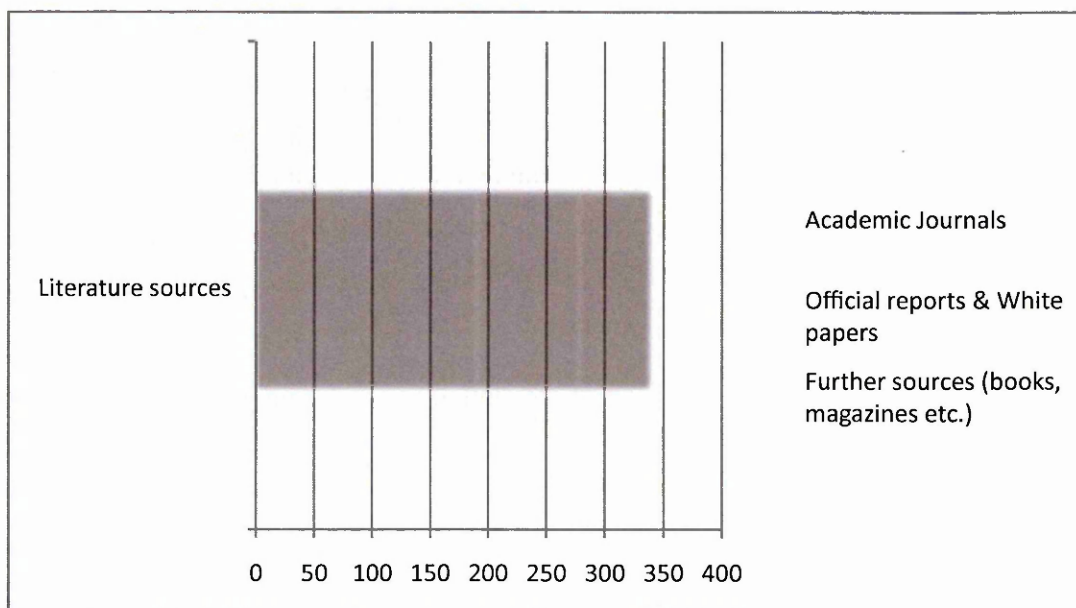


Figure 3.1: Literature Sources

By including a different range of references, this research has achieved the purpose to link with the most recent studies in the same field.

The first part of the literature review is related to the operations research field and describes the process improvement approach Lean Six Sigma. This part illustrates the background to the approach, the use of it in healthcare and a critical view on Lean Six Sigma as perceived by academics and professionals.

The second part of the literature review is related to the change management field and describes the complex nature of change, the definition of sustainability and the inhibitors of change. The literature review is not limited to Chapter 2 but is also presented in the secondary data analysis in Chapter 5.

3.4.2 Questionnaire design and implementation

By reviewing a wide scope of related literature, a standardised questionnaire was created to collect data from NHS Hospitals in UK and around Europe in order to extract their experiences and information with embedding Lean Six Sigma. This includes the status of Lean Six Sigma initiatives in hospitals, the drivers for hospitals to embed LSS in their organisation, the type of barriers encountered when embedding LSS and the type of benefits reported by users of LSS.

Ideas from other successful questionnaires in related fields were considered and adapted in the questionnaire. Careful attention was given regarding clarity of wording and simplicity of questionnaire design. An introduction on the webpage was created to explain the purpose and importance of the research. Furthermore the participants had a clear instruction on how to answer the questions, as multiple answer questions were clearly marked and the answers to the questions were delivered by ticking boxes, which according to Gillham (2002) is a more familiar way for the participants. The structure of the questionnaire followed a clear line with easy and basic initial questions, followed by increasingly more interesting and demanding questions. Questions were

kept short and clear, hence avoiding negative and ambiguous questions in order to obtain valid data.

3.4.2.1 Pilot questionnaire

Piloting the questionnaire is necessary in order to receive a valid questionnaire that measures what it is supposed to measure, and to edit or delete questions which do not enrich the research study. The objectives of the pilot questionnaire were to ensure that it is clear and concise and to assess how much time is required to complete the questionnaire. In addition, according to Neuman (2004) by using pilot questionnaires, the researcher increases the reliability of the questions.

According to Remenyi et al. (1998), conducting a pilot questionnaire can be fairly informal where one consults colleagues and people of diverse opinions. On the other hand, it can be more formal like something of the kind of a small scale study in the same population as the main study.

A pilot questionnaire was conducted with the help of two academic researchers. Face validity was assessed by asking to provide detailed feedback on the overall design, structure and quality of questions. In addition two LSS practitioners were asked to validate the contents of the questionnaire. Following the pilot questionnaire several modifications were made to the wording and scaling of certain questions and questions were deleted and added. Pilot-participants were asked to also give feedback regarding the introduction to the questionnaire, as well as overall reaction to the questionnaire based on their experiences.

3.4.2.2 Questionnaire data collection

Sekaran and Bougie (2010) refer to Roscoe's research, which proposed the following four rules for determining sample size:

1. A sample size between 30 and 500 is appropriate for most research

2. If samples have to be broken into sub-samples (males/females, juniors/seniors etc.), 30 as a minimum sample size has to be chosen for each category
3. The sample size should be several times (preferably 10 times or more) as large as the number of variables in the study when multivariate research is conducted (including multiple regression analyses)
4. For research with tight experimental controls, successful research is possible with samples as small as 10 to 20 in size.

402 emails were sent and 52 participants responded to the Survey, out of which 31 were considered useful (excluding participants with no LSS experience). Based on the rules from Sekaran and Bougie (2010) the sample of this survey is considered acceptable for a descriptive analysis of the results, and represents a response rate of 7.7%.

The survey results are analysed in a descriptive manner and presented in chapter 4. The reason for doing so is that according to several researchers, an inferential analysis of data is less meaningful with a sample of 30. In fact, Langabeer et al. (2009) argued that the common sample size for similar surveys and the inferential analysis of data lies between 50 to 100 responses.

3.4.3 Interpretive Structural Modelling (ISM)

Interpretive Structural Modelling (ISM) belongs to the operations research family of approaches and helps groups of people in structuring their collective knowledge. Warfield proposed ISM in 1973 as a qualitative approach to gain structured insights on complex situations by improving order and direction among variables of a complex system (Talib, Rahman and Qureshi 2011). The variables are often related to each other in a complex relationship. ISM provides structure within this system of complex relationship. The approach is *interpretive* as it relies on the judgement of a group of experts. It is *structural* as it follows a set of steps to extract an overall structure from the complex set of variables. Finally, it makes use of the application of graph theory in such a way that the specific relationships and overall structure are illustrated in a graphical model (Singh and Kant 2008).

ISM has been mostly used to determine the influence of elements (often referred to as enablers or inhibitors) of a system as well as to analyse their relationship, resulting in a structured sequence. Singh and Kant (2008) created a framework for dealing with barriers in knowledge management implementation. ISM provided a hierarchical model, including all barriers ordered by importance (the barriers with highest influence on top of the model). Sagheer, Yadav and Deshmukh (2009) applied ISM in order to determine the hierarchical and contextual relationships between factors influencing food standards compliance in a developing country. Salimifard, Abbaszadeh and Ghorbanpur (2010) examined the relationship of critical success factors for the implementation of Business Process Reengineering in Iranian banks. The proposed framework on how to deal with factors was derived from the ISM findings. Pramod and Banwet (2010) provided with the help of ISM a guideline for future investment decisions for a Telecom company headed by the government of India. Finally, Talib, Rahman and Qureshi (2011) used ISM to understand the mutual interaction among the barriers to Total Quality Management implementation. It resulted in the creation of a model illustrating driving barriers and dependent barriers. Knowing which barriers have the highest driving power (influence) allowed management to shift focus appropriately.

Beside ISM there are other methods, such as the Analytical Hierarchy Process (AHP), which is used when the relationship between factors needs to be quantified, weighing the significance of factors on the whole system. Consequently, Gorvett and Liu (2007) suggested that with increasing complexity of a system resulting in twenty and more factors, a quantitative approach such as AHP is advisable. AHP demands a high sample of participants, but the final result will be a hierarchical structure of factors similar to ISM. The present factors in this study are significantly below twenty, hence AHP was not considered. In addition, literature suggests that CSFs have interdependencies, which is the reason for choosing ISM as it can handle a network of interdependent variables, which AHP cannot.

The above-mentioned cases in literature have all followed a systematic methodology on how to use ISM. This research followed the provided nine (detailed) steps as follows:

- 1) The 11 CSFs were listed as CSFs a-k and were identified through literature review and discussion with experts of the relevant area.
- 2) CSFs identified in the first step were arranged in rows and columns, displaying a matrix where each CSF was related with the other one by one, pair-wise, through rows and columns. The contextual relationship "will help achieve" was established among CSFs in terms of "V", "A", "X", and "O".
- 3) On the basis of pair-wise relationship between CSFs of the system, a structural self-interaction matrix (SSIM) is developed.
- 4) A reachability matrix is then developed from the SSIM by converting the information in each cell into binary numbers "1" and "0", thus an initial reachability matrix is constructed.
- 5) The initial matrix, obtained from step 4, is checked for transitivity, and modifications (if any) are made. The transitivity of the contextual relation is a basic assumption made in ISM. It states that if a CSF "i" is related to "j" and "j" is related to "k", then "i" is necessarily related to "k". Thus, a final reachability matrix is obtained.
- 6) The final reachability matrix is partitioned into different levels on the basis of the intersection set of the reachability and antecedents sets for each of the CSFs and through a series of iterations.
- 7) On the basis of the levels partitions and a final reachability matrix, a conical matrix (lower triangular matrix) is constructed. A directed graph or digraph is drawn and transitive links are removed.
- 8) The resultant digraph is converted into an ISM, by replacing CSFs nodes with statements.
- 9) Finally, the ISM model developed is reviewed to check for conceptual inconsistency and necessary modifications are incorporated through expert opinions.

3.4.4 Semi-Structured Interview

The semi-structured interview can be interpreted as a mix of the methods of structured and unstructured interview. It does not completely follow a specific structure and sequence; hence the questions are not closed questions. On the other hand, it is not unstructured, as the researcher has a clear idea about what to discuss and cannot freely talk about what comes to his mind. The semi-structured interview method offers questions to the interviewees that are open and animate to discuss the topic in detail. This is considered a particular strength of the method, as Interviewees are allowed to talk more in detail and explain their opinion based on their experience or cases they encountered. Additionally, it provides the researcher with the flexibility to moderate the interview, in the sense that some questions can be dealt with quicker as they do not animate further discussions.

According to Willig (2008), the disadvantages of this method are the time and effort required to arrange meetings and perhaps the costs that arise in the form of travel expenses. In addition, the interviewer's skills are tested regarding the ability to think of questions during the interview and the ability to read body signals.

The semi-structured method was chosen to validate the framework presented in Chapter 6. The questions were carefully planned and discussed with researchers. In addition, literature was surveyed to identify how frameworks are validated and explicitly what attributes a framework is evaluated on. The findings indicated that besides validating the framework based on a business case there were ways of validating the framework theoretically. The theoretical validation is built on the fact that every framework has to meet specific attributes to be defined valid. In Chapter 7 the concept of theoretical validation is explained and the attributes are included in the semi-structured interview.

3.5 Conclusion

This chapter discussed the need for an appropriate research design and the right choice of data collection methods. Figure 3.2 summarises the information provided throughout this chapter on the strategy undertaken to answer the research objectives identified in Chapter 1.

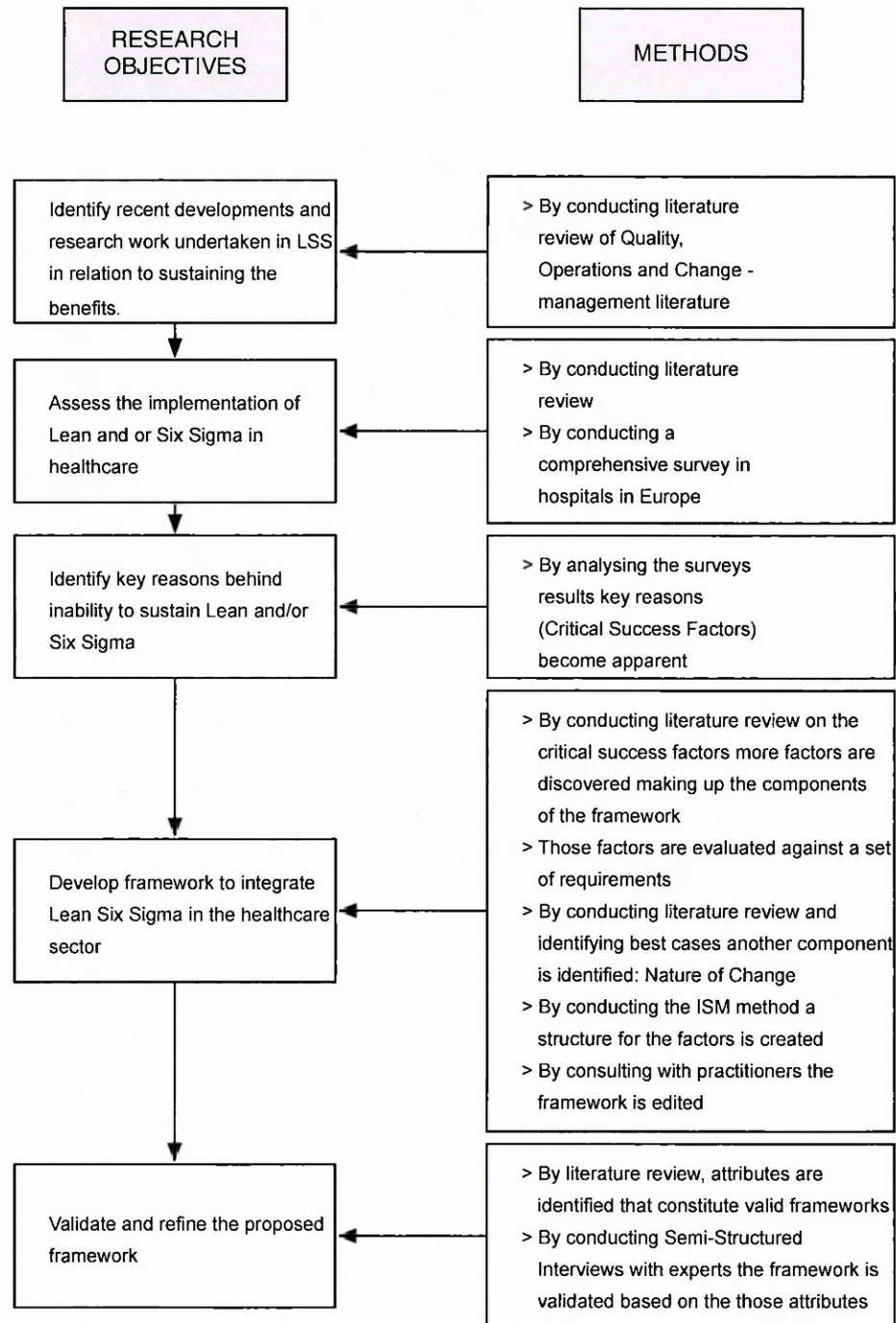


Figure 3.2: Methods Used to Address Research Objectives

CHAPTER 4:

THE USE OF LEAN SIX SIGMA IN HOSPITALS

4.1 Introduction

In the prior chapter, all methods used in this research were introduced. In this chapter, one of those methods is applied and presented.

Chapter 2 provided an overview on the current situation of LSS implementation in healthcare (based on the latest survey results). However, not much is known about the effects that weigh on sustaining LSS. In addition, the latest survey results were from 2008. This survey aimed to capture the current (2010) situation of hospitals trying to implement Lean and/or Six Sigma (henceforth referred to as L/SS). Based on the information from Chapter 4, the next steps in this research were designed. The results were further presented and discussed at the 3rd European Research Conference on Continuous Improvement and Lean Six Sigma (2011).

4.2 Determination of the Survey Sample

The targeted population were Hospitals in UK, Netherlands, Denmark, Germany and Italy, as publications in English were available indicating that L/SS initiatives underway for these countries. For the UK, the list of Acute Trusts was used from the Service Directories on the NHS homepage. For the remaining four countries, several webpages were used to receive a list of university-owned hospitals. The reason for choosing university-owned hospitals was due to the likelihood of these hospitals benefitting from academic research and the small amount of literature cases in English. Furthermore, healthcare professionals were picked from the population based on their job title and respective job description, which indicates an involvement in process improvement initiatives. The keywords which were used to filter were: service transformation, organisation, development, improvement, continuous, quality, change, and facilitator.

1208 emails were collected through this process and structured sampling method was used. Initially, 50 or more respondents were considered appropriate according to similar studies (Langabeer et al. 2009). Therefore, the

structured sampling method came up with a sample size of 402 (every 3rd email from the population of 1208). 52 responses were received, of which 31 questionnaires were filled out completely (21 participants did not pass the initial requirement, stating that Lean and/or Six Sigma experience is mandatory). The expected sample size of 50 was not met; this however is fine, as 31 questionnaires from five different countries were filled out, which aligns with the overall thumb of rule of having at least 30 respondents (see Chapter 3).

4.3 Questionnaire Design

The following were the objectives of the survey:

- What is the status of Lean Six Sigma in hospitals? (To what extent is the combination of Lean with Six Sigma accepted and adapted in hospitals?)
- What are the common tools and techniques employed by hospitals in their projects?
- Are the key factors known which drive organisational change and enable continuous improvement?

The questionnaire was designed using the software SNAP 9. It is an integrated survey data collection and analysis tool with focus on online surveys. The created questionnaire can be exported as HTML files including all necessary PHP files, which are needed to receive responses. SNAP allows a fast way of creating a webpage. In addition, the software allows descriptive statistical analysis of the results, which is sufficient for a good understanding of the results.

The question's response formats were: yes or no, multiple response, Likert scale and open-ended questions. The first question aimed at the experience participants have with Lean and/or Six Sigma, which was made a requirement to fill out the survey. The first question therefore screened out those with no relevant experience. After the initial question, the survey divided into six sections. The first section dealt with basic information such as the location, name of institution, department, job title, the number of employees and the number of beds in the hospital. The second section was designed to find out

how and why the hospital got in contact with Lean Six Sigma, and if any formal training was introduced. The next section dealt with the tools used by the participant and the reason why they were picked, following questions about how the hospital arranges projects. The fourth section is devoted to the implementation process, asking questions about structured approaches used, the reason why this approach was chosen and the resistance encountered in the implementation process. The fifth section focused on the outcome of the improvement effort. Two questions were asked to assess the benefits and impact the improvement had on the hospital, and a further two questions aimed at the opinion and exceptions of the participant. The sixth and final section consisted of questions containing key factors that lead to sustainable change and how hospitals deal with them.

4.4 Conducting the Survey

For the survey it was decided to use e-mail as the distribution source and a webpage as the data collection instrument. The advantages of this approach to data collection are (Collis and Hussey 2003):

- Fast response time. Participants usually answer within one day and most within a few days
- Once set-up has been completed, there is no printing or distribution cost
- Anonymity is greatly assured
- Highly flexibility is offered in times of design, use of fonts and access
- Open-ended questions are likely to be answered in more detail.

4.5 Survey Analyses and Results

Length of Experience & Origin of Initiation

Table 4.1 shows that the majority of respondents have 2 to 5 years of experience using the techniques. Total experience of the sample is approximately 94 years.

Length of Experience	Percentage (%)
Up to 6 months	0
7-12 months	7
1-2 years	32
2-5 years	55
5-10 years	3
10+ years	3

Table 4.1: Experience with Lean and/or Six Sigma

In the manufacturing sector for example, a majority of Lean and/or Six Sigma projects were initiated by senior managers who identified the need for improvements. It is encouraging to note that in hospitals too, senior managers have played a vital role by initiating Lean and/or six sigma projects; in 74% of cases, senior managers led the development of projects. However, in 55% of cases, hospitals also sought services from external consultants to initiate projects.

The survey also queried what drove the hospital to choose L/SS as the preferred technique for process improvement. Improving efficiency and enhancing quality were quoted as the main drivers. Replies also quoted the following drivers:

- "It worked elsewhere in comparable industries"
- "Proven"
- "Because we had seen the benefits in another hospital"

These quotes comply with the common approach hospitals undertake towards using L/SS. Benchmarking and considering best practices has become an important driver for hospitals. They cooperate with manufacturing companies in

order to understand how different tools and approaches work in their environment and if it is applicable in a healthcare environment. In several cases, representatives from hospitals have also received the chance to visit Japan and observe Lean techniques at its best. They were sent to manufactures who perfected Lean and learned the principles at its core. Womack et al. (2005) reported that this resulted in the Virginia Mason Medical Centre Toyota Production System.

Others emphasised the use of Lean as a tool to enable staff:

- “(...) to understand processes within their service” and
- “(...) let Lean become part of everyday work”.

Sense of Urgency & Meeting Expectations

Creating a sense of urgency is a critical success factor. It appears that in this sample, in almost every case, project managers created a sense of urgency. The responses to the question on how L/SS was supported (Figure 4.1) were similar to the responses of a survey conducted in USA by Langabeer et al. (2009).

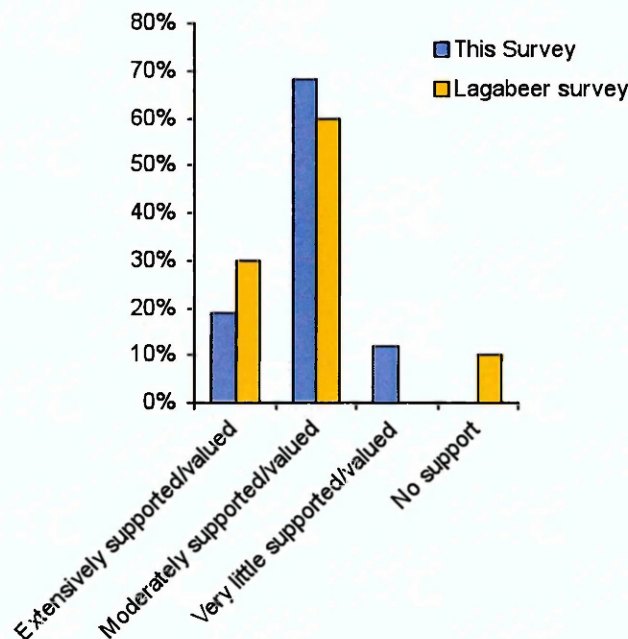


Figure 4.1: Support of Lean and/or Six Sigma

When asked if any formal training in L/SS was organised, not a single respondent stated that they had been trained in Six Sigma (Table 4.2). However, when asked for a list of tools used, the majority of tools had their roots in Six Sigma (Table 4.3). This result coincides with the results drawn from the Proudlove, Moxham and Boaden (2008) study, wherein the focus on Six Sigma was lower than Lean, while having a wide dissemination of Six Sigma tools in the NHS. According to their study, the most useful tools were: project charter, VOC, CTQ, process mapping, Pareto Analysis and Fishbone diagrams. In Table 4.3, all tools except VOC and CTQ were marked with a high score.

Management Philosophy	Percentage (%)
Six Sigma	0
None	7
Lean Six Sigma	19
Lean	74

Table 4.2: Formal training in L/SS

A list of 28 commonly used L/SS tools was provided and the respondents were to identify tools that they used in their projects. Although respondents claimed that Six Sigma is not well practiced in hospitals, most of the top used tools (Table 4.3, highlighted in bold) have their roots in Six Sigma. Six Sigma is considered to be complicated and to unnecessarily delay improvement attempts. Furthermore, it demands rigorous training and seems not to have the “fast result” attempt like Lean tools offer (e.g. 5S). A respondent stated that they “chose Lean (explicitly not Six Sigma) because it integrates flow improvement and efficiency improvement in a sustainable way (by introducing improvement methods that become part of everyday work)”. Rapid improvements and the empowerment of staff to “identify ways of improving processes” seem to work easily with Lean.

According to Antony (2004), process mapping, brainstorming and Pareto analysis in Table 4.3 belong to the most commonly used tools in service organisation. In addition, the survey asked to clarify why the tools were chosen.

The tools were “easy to use and understand” and “effective and easy to teach”. Furthermore, they were already perceived to be “proven tools” that addressed hospitals’ problems adequately. However, nearly one-third of respondents seemed to rely on the chosen tools because of a third party, who “recommended” and “provided” the tools, “as part of training package”. The influence of a third party could also explain the high frequency with which Six Sigma tools appear in Table 4.3. No respondent chose the ANOVA method, DOE, DFSS, Gauge R&R, 8D and TRIZ, as most of these methods are not related to process improvement activities, but more towards measurements or even design issues.

Tools	Score		
Process mapping	100	Statistical Software	35.5
Fishbone diagram	83.9	VoC	35.5
5S	77.4	KANBAN	32.3
VSM	77.4	FMEA	22.6
5 Whys	67.7	Simulation	22.6
Brainstorming	64.5	SIPOC	9.7
Pareto analysis	58.1	CTQ	9.7
Project charter/plan	58.1	OEE	6.5
Control chart	51.6	TPM	6.5
Histogram	41.9	QFD	3.2
Visual Controls	41.9		
Poka-Yoke	38.7		

Table 4.3: List of L/SS tools used

Project Management (Balanced Project-Teams, Clear project initiation, Unclear Information Flow and Missing Understanding of Goals)

Another important aspect for applying L/SS is the prioritisation and selection of projects. Table 4.4 shows that the majority chose “Quick wins” as project prioritisation. Quick wins are important to build excitement and enthusiasm among team members (Westwood and Silvester 2007).

Prioritisation	Percentage (%)
Highest workload first	19
No prioritisation	26
Quick Wins	55

Table 4.4: Project Prioritisation

Initiation	Percentage (%)
Bottom-Up	3
Top-Down	19
Bottom-Up and Top-Down	78

Table 4.5: Project Initiation

Project-Team	Percentage (%)
External consultants	0
Ex. Consultants + Management	0
Management + Staff	39
Ex. Consultants + Management + Staff	61

Table 4.6: Composition of project-teams

Scale	Percentage (%)
No	0
Very little	0
Modest	39
Extensively	61

Table 4.7: Extent of nurse's involvement

Furthermore, projects are often classified as either “advanced” or “Quick wins”, the latter of which refers to Lean projects (de Koning 2006). This result is in accordance with the overemphasis of Lean we received in this survey. According to several practitioners and academics (e.g. George et al. 2003, Antony 2004), projects should be manageable. A project that takes up to 6 months can be categorized as manageable, and allows team members to stay motivated and avoids team disintegration. These types of projects are referred to as “Quick wins”. 26% of the respondents chose either not to prioritise their projects or used a different prioritisation focus.

In order to establish whether staff were empowered, the survey included three questions:

- *How were project-teams put together? (Table 4.6)* – Project-team should engage staff that is involved in the delivery of processes, in order to get practical input. Otherwise, the project-team risks getting highly biased results.
- *How were projects initiated? (Table 4.5)* – Respondents were given the choices Bottom-Up, Top-Down and Top-Down/Bottom-Up. The literature is not clear about which approach is best. However, there is little evidence of using a Bottom-Up approach. Discussed is often a mixture of both approaches, conceding top management’s right to prioritise and decide projects, and the staff role of providing ideas for projects and executing them from bottom-up.
- *To what extent were nurses involved in projects? (Table 4.7)* – The involvement of nurses in projects should be of an active nature, in the sense of actively redesigning processes and not just providing information.

The majority of respondents (80%) stated that their hospitals ran a pilot-project prior to the main project. Initiating a pilot-project is a common approach to learn from the outcome and use the knowledge in the actual project (Jimmerson, Weber and Sobek II 2005). It can be used to specify the goals in detail, which is necessary to attain the goals and ultimately improve performance. Likewise, it has been shown that the less specific the goal, the lower the motivation of

employees to attain goals, which leads to lower performance (Langabeer et al. 2009).

Understanding of Project Goals	Percentage (%)
No	10
Clear	32
Not clear	58

Table 4.8: Level of Project Goals Understanding

Information Flow	Percentage (%)
Only project team	7
Own department	19
Cross departmental	74

Table 4.9: Information Flow

It was surprising to note that in 58% (Table 4.8) of cases, not every team member had a clear understanding of the project goals and 10% reported having no understanding at all. Langabeer's survey (2009) found that a big majority (over 80%) of participants did not specify project goals prior to the project initiation. A common response to this result was that the project teams made their best attempt to deliver results and a stated goal was not seen as important.

To assess the level of communication, the survey asked how the information was shared after projects finished. We expected a high percentage of responses (Table 4.9) towards sharing the information cross-departmentally, as this assures benchmarking and supply of best practises. Nevertheless, a little more than a quarter of respondents reported restricted communication flow, whereby information at the end of the project was shared only in one's own department or own project team. Also a crucial part that influences communication is the work environment (Maleyeff 2007; Smith, Barry and Brubaker 2007). Table 4.10 shows the extent to which participants are supported to speak out when codes of practice, standards or ethics are violated. With an approximate average of 3 years of L/SS experience we expected a clear statement towards this question. Surprising, 13% of respondents were working in an environment where speaking up is not tolerated.

Scale	Percentage (%)
Very Little	0
Never	13
Modest	32
Extensively	55

Table 4.10: Staff supported to speak out freely

DMAIC Comes Off Second Best

Respondents were given the choice to pick between structured approaches, which are used throughout several cases in literature. Responses were leaning towards more established and proven approaches. As Table 4.11 shows, PDCA was chosen as the preferred structured approach, and only 7% picked the NHS Work Process Methodology. DMAIC was picked half as much as PDCA, which was unsurprising, because PDCA is often used as an implementation approach in Lean projects. 13% did not have a structured approach at all.

Approach	Percentage (%)
WPM	7
No approach	13
DMAIC	25
PDCA	55

Table 4.11: Structured Implementation Approach

Issues Encountered During Implementation

The two most mentioned issues (above mean 44%) encountered during implementation were: lack of commitment (52%) and resistance (52%). Lack in communication accounted for 42%, following lack of tools, lack of support and hasty implementation with each 39%. However, all frequencies are close to each other indicating a low variation.

Highly Beneficial for Medical Services

80% of respondents felt that “medical services” was the area that experienced the greatest impact regarding the use of L/SS, followed by administrative processes with 20%. No reports were given concerning pharmaceutical operations, financial processes and information system. Participants were asked to define the benefits, which were achieved allowing multiple responses. An improvement in quality was reported by 74% of respondents as a benefit

from L/SS initiatives. Organisational benefits, such as the change of procedures or rules and the improvement of delivery (e.g. reduced patients lead-time) were ranked second, each with 68% responses. Only 45% of respondents felt that low costs and cultural benefits arise as a benefit from L/SS initiatives. The reported order of benefits shows the differences between Hospitals and manufacturing as latter often mentions low cost and improvement of delivery as most important benefit.

4.6 Limitations

There are three main limitations to this research:

- First, as this research was conducted in the UK, we focused on hospitals in the UK (NHS Acute List). For the other countries we focused on university-owned hospitals, as they are commonly more research oriented. The ratio of emails sent to UK hospitals and to the other Hospitals was 2.75: 1. We therefore had a high response rate coming from the UK.
- Second, the sample size is small. We knew at the beginning of this research that there is a small population of hospitals that apply L/SS, based on the fact that L/SS in hospitals around Europe have not even been used for a decade yet (compared to USA). However, we would have liked a much larger sample, which would have allowed a greater level of analyses. Therefore this study is not intended to be conclusive, but rather give some initial overview of how L/SS is used in hospitals.
- Third, this research may be limited due to respondent bias. The sample was composed of healthcare professionals who primarily get in contact with improvement initiatives (nurses, operation managers, quality professionals, Lean facilitators). Their responses may not be representative of healthcare professionals, who were not in the researched sample.

4.7 Conclusion

The results of this survey show a focus of hospitals on Lean. There are fewer Six Sigma cases in literature in the healthcare industry, which is attributed to the complicated nature of this management philosophy. Hence, the results show no formal training in Six Sigma but to some extent in Lean Six Sigma. The respondent's tendency towards Lean is also reflected in the prioritisation of projects and the choice of structured approach. "Quick win" was chosen as measure to prioritise projects and respondents chose PDCA as their preferred structured approach. As PDCA is not thoroughly defined and allows more freedom in adapting it to the hospital's needs. DMAIC on the other hand, is a ready-made methodology that comes with a predefined sequence of steps and does not allow skipping them. Neither PDCA nor DMAIC have a strong focus on sustainable improvement. The list of tools which respondents were asked to pick from is an Indicator for a combined Lean Six Sigma approach, as the tools were uniformly distributed between Lean and Six Sigma. Combining Lean with Six Sigma creates a pool of tools, each for different situations and allowing the user to benefit from the best of both approaches. However, all efforts are meaningless without a transformation of organisational culture from 'fire-fighting' to 'fire-prevention'. Unless hospitals are able to empower their staff, ensure continuous training and measure the effectiveness of the programme, no sustainable solution can be embedded in the organisation.

The major finding of this survey is the fact that CSFs for sustainable improvement have not been thoroughly focused upon. Yet, they are crucial for a successful application of improvement initiatives. Respectively, the results show a lack in goal specificity, moderate support for L/SS initiatives and a moderate level of communication. Clear statements were given regarding the empowerment of employees, as teams were thoroughly balanced, projects were initiated in the right order and nurses were actively involved in redesigning processes. On the down side, the working environment did not entirely support staff to speak up. This is a clear inhibitor for the sustainability of process

improvement programmes. The key factors for sustainable LSS are therefore either not known or not perceived to be critical, and hence they are addressed half-heartedly.

The next chapter addresses factors critical for a sustainable LSS.

CHAPTER 5:

IDENTIFICATION AND ANALYSES OF CRITICAL SUCCESS FACTOR

5.1 Introduction

Chapter 4 provided information on the actual situation in hospitals regarding the use of Lean and Six Sigma. Beside the high aversion towards Six Sigma, what became apparent was the weak knowledge and use of critical success factors for LSS.

This chapter attends to the outcome of Chapter 4 and identifies the CSFs for the integration of LSS in hospitals. Chapter 2 discussed the term of CSF, therefore this chapter identifies the CSFs and evaluates the sources. In addition, the CSFs are identified based on the requirements that they are reported in a healthcare or non-specific organisation setting and use Lean and Six Sigma. After the evaluation of the sources, the CSFs are presented in Section 5.3 and the barriers and ways to overcome them are reported. Section 5.3 represents the identification part of this chapter. Finally, a method to assess the relationship between each CSF is presented in Section 5.4, and a model is created based on the data from ten LSS experts. Section 5.4 represents the analysis part of this chapter.

5.2 Determination of CSFs

The quality of data, especially secondary data, is imperative in order to assess the validity and relevance of data. The presented CSFs are evaluated under a proposed set of questions from McCasten (2005) to determine data quality:

- What are your source's credentials?
- What methods were used?
- Is the information current or out-of-date?
- Is the intended audience other researchers or the general public?
- Is the document's coverage of the topic area broad or too narrow?
- Is it a primary or secondary source? If it is a secondary source, does it accurately cover and report on the primary sources?

- Does the author provide references for the data and information reported?
- Do the numbers make sense? When compared to related data are the measures somewhat consistent?

Most of McCasten's questions can be generally answered in a straightforward manner. Questions referring to the coverage of the topic and comparing the data from the source with other sources rely on the judgement of the researcher. McCasten's questions are considered as an evaluation guideline providing information on quality and actuality of sources.

5.2.1 Mapping Literature

This research considered Lean, Six Sigma and Lean Six Sigma CSFs for the integration in a healthcare environment. In addition, CSFs for LSS integration mentioned in publications referring to no specific sector were considered for the richness of the data. Hence, Table 5.1 lists all CSFs regarded in this research and the relevant sources.

Chapter 2 has shown that CSFs for sustaining Lean Six Sigma are not determined based on the industry sector. Nevertheless, some CSFs are frequently mentioned as important to the specific industry sector compared to other CSFs. This research initially considered 27 papers focusing on CSFs from various sectors. 10 papers were considered for the analysis based on the focus of this research being on the healthcare sector. After only considering 10 papers (of $n=27$) the number of CSFs (11) did not change, which confirms the expectation that CSFs do not differ based on industry sector. Looking at Table 5.1 it becomes apparent that some CSFs are mentioned more frequently in sources than others. A CSF that stands out is "creating sense of urgency", which was only mentioned by one paper. Beside that paper, cases in literature report of sense of urgency being important to successfully change organisations, as urgency gives a strong indication of top management commitment. However, it is rarely mentioned in conjunction with other CSFs.

This and other anomalies also led to research on the relative importance of sense of urgency compared to the other CSFs using Interpretive Structural Modelling.

CSF No.	CSF	Reference
1	Management Commitment	Antony and Banuelas (2002); Waxer (2010); Sears (2009); Antony et al. (2007); Powell, Rushner and Davies (2009); Westwood and Silvester (2007); Naeslund (2008); Antony (2004); Radnor et al. (2006); Natarajan (2006)
2	Clear Vision	Antony and Banuelas (2002); Powell, Rushner and Davies (2009); Naeslund (2008); Antony (2004); Radnor et al. (2006)
3	Training/Education	Antony and Banuelas (2002); Waxer (2010); Sears (2009); Antony et al. (2007); Powell, Rushner and Davies (2009); Westwood and Silvester (2007); Naeslund (2008); Antony (2004)
4	Communication on all Levels	Antony et al. (2007); Powell, Rushner and Davies (2009); Naeslund (2008); Antony (2004); Radnor et al. (2006)
5	Clearly defined Goals	Antony and Banuelas (2002); Powell, Rushner and Davies (2009); Naeslund (2008); Antony (2004); Radnor et al. (2006)
6	Resources	Waxer (2010); Sears (2009); Powell, Rushner and Davies (2009); Radnor et al. (2006)
7	Incentive	Waxer (2010); Antony (2004); Natarajan (2006)
8	Project Management	Antony and Banuelas (2002); Antony et al. (2007); Powell, Rushner and Davies (2009); Naeslund (2008); Antony (2004)
9	Create Sense of Urgency	Sears (2009)
10	Understanding of Processes	Sears (2009); Westwood and Silvester (2007)
11	Performance Measurements	Powell, Rushner and Davies (2009); Antony (2004);

Table 5.1 - CSFs for Sustainable Lean Six Sigma in Healthcare (Mentioned in Literature)

5.2.2 Evaluation of Secondary Data

Table 5.2 shows the validation of each paper considered as secondary data. It follows the guidelines of McCasten (2005) presented in Section 5.2.

	Antony and Banuelas (2002)	Waxer (2010)	Sears (2009)
What are your source's credentials?	Researchers: Research Student and Senior Lecturer	Six Sigma Practitioner and Master Black Belt	Director of performance improvement/knowledge transfer and MBB at Hospital in USA
What methods were used?	Literature Review	Best practices and practitioners experience	CSFs generated by relevant experience across 29 facilities
Is the information current or out-of-date?	(2002)	(2010)	(2009)
Is the intended audience other researchers or the general public?	General public and researchers	General public	General public (practitioner related)
Is the document's coverage of the topic area broad or too narrow?	Broad: Exploratory study and including success and failure studies of organisations from no particular industry.	Broad: On Six Sigma but without a particular industry in focus.	Narrow: The CSFs are covered specifically for the organisation's approach "Enhancing Performance Excellence" with LSS
Is it a primary or secondary source? If it is a secondary source, does it accurately cover and report on the primary sources?			
Does the author provide references for the data and information reported?	Primary source	Primary source	Primary source
	Sufficient	No	Moderately
Do the numbers (CSF) make sense? When compared to related data are the measures somewhat consistent?	They are comparable to CSFs illustrated in other publications. Exception are "Linking Six Sigma to customers", "Linking Six Sigma to suppliers" and "Linking Six Sigma to employees"	They are comparable to CSFs illustrated in other publications.	They are comparable to CSFs illustrated in other publications. Exception is "Employment processes, methodologies and tools that enable swift change and high quality solutions". This CSF could not be categorized as its definition is too general.

Table 5.2: Evaluation of Papers of CSF for LSS integration (After McCasten, 2005).

Antony et al. (2007)	Powell, Rushmer and Davies (2009)	Westwood and Silvester (2007)
Researchers with profound experience in quality process improvement & Director of Quality in healthcare sector	Researchers: Research Fellow, Senior Lecturer and Professor in health and management related areas	Former physician/Consultant and LSS specialist working for NHS
CSFs generated by discussion and relevant experience (2007)	Literature Review (2009)	CSFs generated by discussion and relevant experience (2007)
Researchers and general public	NHS Scotland staff	General public
Broad: CSFs for Six Sigma deployment in healthcare.	Broad: A report reviewing literature and cases at NHS about quality improvement	Narrow: CSFs for NHS transformation using LSS
Primary source	Secondary Source. Derived CSFs from the following sources: Pollitt 1996; Ovretveit 1997; Ferlie and Shortell 2001; Grimshaw et al. 2001; Looock 2001; Ham et al. 2003; Greenhalgh et al. 2004; Touati et al. 2006; Dickinson and Ham 2008; Ward et al. 2008.	Primary source
Sufficient	Extensive	No
They are comparable to CSFs illustrated in other publications.	They are comparable to CSFs illustrated in other publications. Exception is "Recognise quality improvement is a long term issue". This CSF could not be categorized as its definition is too general.	They are comparable to CSFs illustrated in other publications.

Table 5.2: Evaluation of Papers of CSF for LSS integration (After McCausten, 2005).

Naeslund (2008)	Antony (2004)	Radnor et al. (2006)	Natarajan (2006)
Professor Marketing, Management and logistics	Researchers and Practitioner in Six Sigma	Researchers and Practitioner in Lean	Researcher
Extensive Literature Review of academic papers of the previous 30 years (2008)	pilot Survey (2004)	Survey and Case studies (2006)	Literature review: Best practices and success/failure stories (2006)
Researchers	General public and researchers	General public (scottish public sector)	General public and researchers
Broad: Focusing on critically comparing JIT with Lean and TQM with Six Sigma. CSFs are collected from Lean and Six Sigma independently	Broad: Uk service organisations	Broad: Scottish public sector	Broad: Best practices in healthcare regarding Lean or Six Sigma
Secondary source. Extensive sources referenced, going back up to 30 years	Primary source	Primary source	Primary source
Extensive	Sufficient	Sufficient	Sufficient
They are comparable to CSFs illustrated in other publications.	They are comparable to CSFs illustrated in other publications.	They are comparable to CSFs illustrated in other publications. Exception "external support" and "turning"	They are comparable to CSFs illustrated in other publications. Exception "External compulsions by the consumers, purchasers, payers, accreditation bodies and regulators"

Table 5.2: Evaluation of Papers of CSF for LSS integration (After McCasten, 2005).

5.3 Final CSFs

In the following, the background of each CSF and its appearance in healthcare is described. Barriers are then identified which stand in the way of achieving the CSF. Finally, ways of overcoming those barriers are proposed.

5.3.1 Top Management Commitment

Top management commitment refers to the commitment that top management provides during the integration of LSS in the organisation. According to Antony et al. (2007), top management commitment is perceived as a critical factor without which change is almost certain to fail. Management functions as a role model guiding staff in the right direction and showing high involvement in processes. A survey conducted by Radnor et al. (2006) clearly reported a downturn in commitment by staff in cases where top management was less involved. The positive correlation between staff commitment and top management commitment can be observed in several cases throughout healthcare (Radnor et al. 2006). The importance of top management commitment becomes clearer taking Scott et al.'s (2011) study into account. They conducted a study involving hospitals in Australia to find out the relationship between internally and externally led intervention. They came to the conclusion that internally led redesign resulted in superior and sustained improvements. This was due to the higher commitment by top management, as the projects were their responsibility. The high commitment of top management also inspired frontline staff, resulting in superior results compared to externally led projects.

Academics and professionals agree on the fact that top management commitment should be on-going and delivered in a practical and public way, with public commitment being very crucial. According to Kotter (1995) and Strebel (1994), involving public opinion results in an additional control mechanism in order for the organisation to stay on course.

Sears (2009) stated that the currency of top management commitment is time, implying that all efforts should be strategically aligned and deployed. This is in accord with the definition of a leader given by Northouse (2010), as someone with the capacity to create a compelling vision and lead the people towards that vision by translating the vision into action.

5.3.1.1 Barriers

As stated previously, top management commitment should be on-going and delivered in a practical and public way. That said, commitment provided by management often lacks the sincerity and visibility that is needed to support change. Sincerity is lacking when top management create contradictions between what they say and what they do. Oltra (2005) emphasised the need for top management to be modest in formal statements and to act consistently with them rather than rhetorically being overambitious but not matching the claims they make in practice. In addition, by visibly committing and making the efforts public, top management puts themselves on the spot, risking criticism.

Liebler and McConnell (2011) argued that many initiatives in healthcare fail because of insufficient top management commitment. The failure is caused by superficial commitment at the top, resulting in weak commitment at the lower levels. They further warned of very high initial commitment in initiatives, often followed by an abrupt decline of involvement, due to pressing business, resulting in the practice of transferring the guiding role to subordinates.

5.3.1.2 Ways to overcome barriers

The literature is not very clear on this topic, as with a few other CSFs. Overcoming the barriers and realising real top management commitment can be achieved by taking the warnings provided by the literature into account and learning from past cases.

Frequent warnings relate to top management not being consistent. This can be contained by involving a third voice and making the change public. Talking about the change and openly discussing the mistakes of the organisation has

been shown to contribute positively to change under the condition that a detailed plan is in place to tackle the change.

In addition, top management should know what the change is and why change is needed. Kotter (1995) realised that top managers who could not explain what they were doing and why change was needed in a short timeframe of five minutes were not fully committed. This was based on his experience in over 1000 change projects. Furthermore, Mehta (2005) suggested using an open-letter policy for weekly meetings. The letter includes the organisations' vision statement and its detailed goals. At every weekly meeting the management has to read out the letter in order to keep everyone involved and not cause any room for doubt.

In order to receive the support and commitment from top management it is also essential to select projects that are tied to strategic business focus (Antony et al. 2007). A recent publication indicated that a top-down approach is very likely to gain top management commitment, as "the CEO and senior management team own it, support it and drive it". (Kumar, Antony and Tiwari 2011). They further argued that top management should take time to define the purpose and scope of the initiative and link it to the mission and vision of the organisation.

5.3.2 Clear Vision

Throughout the literature, several leading change management researchers have presented different definitions regarding the term "vision". According to Senge (Harris 1995), vision incorporates and fosters genuine trust and commitment in the organisation. He further explained that vision reflects a picture of the future, which is shared by individuals working in the organisation. When creating a vision he emphasised the need to involve a diverse group of individuals, and not just include senior management.

For Nanus (1992), a vision provides a realistic, credible and attractive future for an organisation. It has to be based on reality in order to be meaningful and achievable. It has to be inspiring and believable in order to provide purpose and

direction for the employees. Furthermore, employees need to feel that they want to be part of the organisation, as the vision is attractive.

The importance of a compelling vision is made clear by taking Kotter's (1995) eight steps to transformation into account. Three of the eight steps are reserved and linked to vision. The steps are consecutive and involve the creation (3rd step) and communication (4th step) of the vision, and the active empowerment of employees to act on the vision (5th step). The best vision incorporates the thoughts of many individuals on the picture of the future and is easy to communicate to the rest of the employees. He further argued that the initial draft of a vision is supposed to be disseminated quickly, but this is by no means conclusive or compelling; rather the initiative remains "a bit blurry" (Kotter 1995, p.63). Further work will be needed to shape the draft, which can take up to 12 months. In addition, communicating the vision is essential in order to not let it lose importance and disappear. Finally, the group which created the vision has to empower other employees to take action and try new approaches. This can only take place when obstacles to the new vision are removed.

5.3.2.1 Barriers

Kotter (1995) reported cases wherein visions were developed that did not have any ties with staff and were too complex and abstract to understand and explain. According to Kotter, creating a vision for the sake of having a vision is what happens at many organisations, and this explains the failure of many projects. Additionally, most visions are not well thought through and can hardly be explained in five minutes, which is an indication for a vision that will fail to capture the interest of the staff.

In the case of NHS, prior to developing a vision they had to face significant variations in the quality of care they provided (Cave et al. 2008). As the creation of a vision requires knowing how the business works (e.g. providing care), it often happens that an organisation faces challenges that it did not expect. This variation is caused by being unclear about the purpose and the values of the business, including not agreeing on how business should look in future (Blanchard 2010).

5.3.2.2 Ways to overcome barriers

It is imperative that visions are created by an interdisciplinary team. Therefore, key employees (employees who have responsibility or high influence on others) need to be picked from different departments. Experts in Change Management, such as Kotter or Maurer, communicate the importance of taking time to create a vision and to hold frequent meetings wherein the vision is discussed. Frequently held meetings guarantee continuous work on developing a vision and keeping the team members on track and updated. Kotter suggested several months up to a year on discussions regarding the development of a vision.

Finally, Blanchard (2010) highlighted three points that have to be considered when developing a vision. First, one should consider the significant purpose of the business asking questions such as why we exist and why we do what we do. Next, the picture of the future should be considered, questioning what the future will look like when successful. Finally, clear values asking should be considered by asking what guides behaviour and decisions on a daily basis.

5.3.3 Training/Education

Lack of proper training and education exists at all levels of an organization, and is a large contributor to the resistance of employees. The more unprepared employees are, the more likely it is that they will resist change. Lean Six Sigma requires a committed, well-trained, and educated work force engaging fully in quality improvement activities. Moreover, the variety of tools demand training ranging from basic to advanced knowledge. However, training and education is not only necessary from a tool perspective but also from the employee's way of thinking. Näslund (2008) argued that if employees were educated in a systems and process view of organisations, questions such as why change is needed, how change will be undertaken and what benefits can be reaped would be easily answered. Experience with process improvement techniques in healthcare has shown the importance of focused training and a well-educated workforce. According to Natarajan (2006), over 15 years of experience in healthcare have shown that training needs to arise early and be continuous.

This would contribute to involving physicians, who often are considered the main source of resistance.

In addition, Randolph et al. (2012) concluded that a major reason Cabarrus Health Alliance (USA) transformed into a continuous quality improvement culture is basic quality improvement training and annual refresher training for all clinical services staff. This coincides with the insight Sears (2009) gained at his workplace, wherein every staff member is trained as a White Belt in order to guarantee that everyone has basic knowledge on the needs of Lean Six Sigma and speaks the same language.

A rigid training system, focusing on principles and implementation of Lean Six Sigma, is provided and certified according to coloured-belt levels (referring to the skill level in karate). The recognised certificates are Green Belt (intermediate), Black Belt (advanced) and Master Black Belt (highest degree). Each of these qualifications demands a specific knowledge in quantitative analysis and an increasing use of the over 100 tools that LSS provides. A few organisations offer a kind of introductory training, which is referred to as Yellow Belt. Certifications such as White Belt have recently emerged to symbolise a more basic introduction to Lean Six Sigma. Nevertheless, neither White nor Yellow Belt is suitable to engage in improvement projects, as the necessary quantitative analysis training is missing (Pyzdek and Keller 2010).

There is consensus among professionals and researchers about the requirements for Black Belts. They are required to have knowledge in leading projects and need to have led a minimum of one project, according to the certification standard, which is often DMAIC. Meisel et al. (2007) stated that a typical Black Belt needs to have 20 days of classroom training over a four-month period, in which he works on a project following the DMAIC methodology (Define, Measure, Analyse, Improve, Control). Antony et al. (2007) went further, arguing that Black Belts need to work on two projects as part of their certification process, and concluded that Black Belts need to spend the majority of their working hours (80%) on improvement projects. The requirements for Green Belts on the other hand strongly differ. Organisations have different standards for Green Belts, some requiring a project as part of their certification

process and others not. It is possible to achieve a Green Belt without once having used the DMAIC methodology in a project. This is possible as no standard body is available providing a quality standard for the certification. Hence organisations have to investigate how the certification took place when looking to employee Black or Green Belts.

5.3.3.1 Barriers

Only a few articles have reported project failures using Six Sigma or Lean. These articles mention in accordance with each other the lack of training prior to and during the projects (Chakravorty 2009). Another obstacle is the language/terminology used with Six Sigma, which is considered to be a barrier in the NHS (Proudlove, Moxham and Boaden 2008). The use of complex terminology and statistics demands thorough and time-consuming training. In addition, Proudlove, Moxham and Boaden argue that the formal belt-certification and the use of DMAIC would emphasise a tools over problem-solving mentality.

Lean Six Sigma certification lacks a certification body of knowledge which upholds an international standard for qualification of Belts (Carleysmith, Dufton and Altria 2009). Basically, any organisation can certify their employees in various Belts, therefore organisations have to assess the quality of the qualification by different means. However, this allows organisations to tailor the training of Belts according to their own needs.

Finally, it should be noted that training programs that are effectively designed can be incorrectly implemented. Tatikonda and Tatikonda (1996) discovered that even though employees learned to use the statistical process control (SPC) technique; they were not informed as to where to use it. This underlines Antony et al.'s (2007) statement, that training should be focused on the execution of tools in projects.

5.3.3.2 Ways to overcome barriers

Six Sigma's terminology and complex use of statistics is considered a hindrance in training staff. The certification levels range from easy to difficult to understand

and use and can be utilised accordingly. It is not necessary to train every staff member to Green Belt standard, and according to Kumar, Antony and Tiwari (2011), Master Black Belts are also not needed in small and medium organisations. Best practices have shown that all staff members need to have introductory training to Lean Six Sigma, hence the availability of White and Yellow Belt certification (Sears 2009; Randolph et al. 2012).

Furthermore, in order to prevent the false or uncertain use of tools, organisations need to set their own quality requirements for certified Belts. Considering where certification was obtained, if it was obtained through projects, the toolset which was used and the time from classroom training to certification spent are some requirements which can be considered to assess the level of quality of a particular certification.

5.3.4 Communication at all Levels

Communication is an essential factor for a successful project. Clear and effective communication of the need to change can be a strong enabler, or using communication as a means of motivating and overcoming employee resistance to change can enable sustainable change. According to Found, Beale and Rich (2006), communication is often overlooked by management and absent communication can be the cause of failed projects. This state can be observed within public services, wherein lack of communication often leads to anxiety and concern amongst staff (Radnor and Bucci 2008).

Communication is crucial, as it is at the core of any change project. Organisations thinking about integrating process improvement techniques always face the “how to” question. Should the project proceed by integrating bottom-up or top-down? Organisations have several layers through which information needs to pass; hence decisions from top management take longer to reach front-line staff. As a result, a traditional top-down approach inhibits bottom-up communication and thus prevents organisational learning (Anand et al. 2009).

Literature in the area of Change Management and Lean Six Sigma report from a tool used to enhance open and honest communication and work as a link between top management and front-line staff. Change Agents facilitate the integration of process improvement techniques and are proficient with several change management techniques. These facilitators support communication in the organisation by engaging staff in projects and foster interdisciplinary communication (Greenhalgh 2004, Thompson 2010).

5.3.4.1 Barriers

Radnor et al. (2006) reported cases wherein the implementation of changes were blocked due to the lack of support or capacity of senior management:

“The outcomes of the project had been communicated to senior management but to nobody else. However, it should be observed that even some of the changes were not communicated to senior management very deliberately. In some cases some of the changes were deemed not to be part of government policy or department policy and this would cause senior management to react unfavourably to the change suggestions. Therefore some changes have taken place quietly without senior management knowledge”. (Radnor et al. 2006, p.45)

This statement illustrates how unilateral communication can be, and the consequences this may have. Change still took place despite it not being openly communicated. Similarly, there are cases where change does not take place because of an unfavourable attitude of the top management towards change was anticipated. This inhibits and causes staff to fear open communication.

Communication is often used to deliver information infrequently whenever the need emerges or time is of importance. Researchers have communicated the importance of frequent assessment on results in order to keep up the momentum and interest for Lean Six Sigma. Antony and Banuelas (2002) argued that reviews have to take place on a periodic basis. This will provide insight and guide employees through the LSS journey (Jeyaraman and Kee Teo 2010).

Additionally, staff are sometimes unable to see the bigger picture, and often question the position of change in the organisation when coming in touch with improvement techniques (Radnor and Bucci 2008). There are ways to overcome this situation by making the staff more attached to their projects and their results. Maleyeff (2007) argued that visual management can help communicate the existence of problems, but that it is often used inconsistently.

5.3.4.2 Ways to overcome barriers

The work environment has to be blame-free and allow errors to be reported, which conversely allows fast root-cause analysis in order to solve errors. The realisation of a “no-blame” culture has been reported throughout literature as the most discussed topic (Øvretveit 2009). The Virginia Mason Medical Centre introduced a Patient Safety Alert system, which requires staff to immediately report mistakes. They were able to change the ambience of their working environment from a blame culture into one of safety and continuous improvement (Mazzocato et al. 2010).

Communication has to be frequent and can come in the form of a frequent assessment of Lean Six Sigma results (Antony and Banuelas 2002, Jeyaraman and Kee Teo 2010). Hagg et al. (2007) suggested additionally displaying the results of the assessment in the working area (gemba) to provide visual feedback to the staff of their performance against goal.

Additionally, in order to make staff see the bigger picture and feel more attached to the projects, communication methods used by Toyota can be used. Toyota enables their workforce to present their successes with Lean and their participation at different projects on a story board. These story boards are placed somewhere popular for visitors to see and motivate the employee to talk about performance and success when asked. Toyota has shown that this measure increases the motivation of the workforce and makes them feel proud to be a member of Toyota, thereby inducing optimal effort in their projects (Westwood 2006, Maleyeff 2007).

Finally, in order to prevent misleading communication and to support bottom-up communication, the provision of a communication plan can be considered. Bigelow et al. (2010) created a communication plan defining the daily/weekly/monthly/quarterly responsibilities for all levels of staff and corresponding communication plans (e.g. a Technologist has to read shift reports from the previous shift and day, communicate verbally between shifts etc., and a Manager has to be visible in the department to hear concerns and issues, asking Lean and process questions to staff etc.).

5.3.5 Resources

The allocation and availability of resources is a widely discussed topic, and current research is focusing on the relationship between resources and organisational performance (Barney, Ketchen Jr. and Wright 2011, Brahma and Chakraborty 2011). In general, resources are categorised in enabling and value-driving resources. The latter refers to intangible resources, which are identified by making explicit how stakeholders can be satisfied (Puente and Ritchie-Dunham 2010). They drive value for the stakeholders and the organisation and are expressed by product quality, trust or perceived customer satisfaction. On the other hand, enabling resources exist to create value for the stakeholders and are expressed by the organisation's financial resources, human resources, physical resources and technology resources (Ritchie-Dunham and Puente 2008). According to on-going research regarding the relationship between resources and organisational performance, the competitive advantage of an organisation is determined by how enabling resources are being used to influence value-driving resources. This part of research will focus on the enabling resources, as they are the core of the allocation of resources.

However, before referring to the enabling resources, it is imperative to understand that resource allocation comprises different levels, starting from the national over the regional to the institutional level (Leatherman and Sutherland 2008). On a national and regional level, the allocation of resources differs from the institutional level, as the ethical component takes a dominant role. According to the ACP report (2011), questions such as the right allocation

mechanisms and the definition of a just decision (fairness) are on the forefront at national and regional levels. Nevertheless, hospitals also will have to face the same questions, albeit on a smaller scale.

For a number of reasons, top management needs to be actively involved in projects as they have the power to allocate resources effectively (Powell, Rushmer and Davies 2009). Human resources are needed to coordinate and manage projects. Allocating the right people to projects with the right skill set can mean the difference between a successful and a failed project. Human resources have two specific objectives: to increase employee satisfaction and loyalty and to increase the effectiveness in resource utilisation. According to Grigoroudis, Orfanoudaki and Zopounidis (2012), the latter causes hospitals to struggle with the allocation of resources.

According to Wong (2005), gaining top management commitment will not help much if adequate funding is not provided. Proper budgeting of resources is crucial, all the more when the possibility of achieving short term-wins is rare. Researchers have shown that there is a strong relationship between resources and short-term wins. Kotter (1995) included the systematic planning and creating of short-term wins in his eight-step model as step six. This has several reasons. To begin with, achieving short term wins (also called quick-wins) is a means of showing progress and celebrating success. Integrating Lean Six Sigma in an organisation is a long-term project and in order to keep up motivation many milestones have to be placed and celebrated when successfully reached. Additionally, short-term wins act as an incentive for top management to allocate further resources. Edwards (2006) argued that in order to obtain investment from the government for projects within the NHS, results have to be delivered. This is where short-term wins come in, as they can be reaped in a matter of weeks or up to 6 months, convincing top management and government to further invest in the cause (Found, Beale and Rich 2006, Scott et al. 2011).

The last two enabling resources are technology and physical resources. Regarding technology, LSS demands the use of statistics, which need to be handled using a personal computer. In addition, it includes the whole

technological infrastructure of the hospital and the use of an ERP (Enterprise Resource Planning) system (including the skills to handle the technology). Physical resources represent all materials, components and facilities in a hospital. Both resources are seldom mentioned in process improvement cases in hospitals.

5.3.5.1 Barriers

Only a few cases have reported of wrongful allocation of resources in LSS initiatives. Management typically welcomes the new philosophy initially and shows strong commitment; this commitment then fades, and so does the willingness to allocate further resources (Iles and Cranfield 2004, Oltra 2005). In fact, the presented CSFs have a significant influence on the allocation of resources. Resource allocation can suffer from lack of management commitment, a weak/missing vision, weak performance measurements, bad communication or ill-defined goals.

According to ACP (2011), the correct allocation of resources should not only focus on the factors of clinical effectiveness or costs. Hospitals too often ignore other influential factors for a resource allocation. The decision to allocate resources ignores the patient needs, safety, impact on families and caregivers etc.

5.3.5.2 Ways to overcome barriers

Firstly, top management should be aware of the existing resources in their organisation, therefore human, financial, technological and physical resources should be considered. Anand et al. (2009) provided an example of human resource allocation, stating that organisations should redeploy their full-time project leaders to functional areas in their organisation. Bonacorsi (2005) advised that staff with Black Belt certification (who should be working full-time) are redeployed after a period of 18-24 months, working on at least 6-8 projects. Regarding financial resource allocation, Westwood and Silvester (2007) argued that Finance Managers have many things to consider. They should manage demand and not output, as focusing on the latter does not allow for long-term

thinking. Finance Managers in the NHS prefer to approach decisions from a short-term financial point of view in order to balance the books every financial year. For example, there are many cases of Finance Directors imposing blanket cost-cutting measures in every department, regardless of the need of each department. The consequences show at the end of the process, as waiting times increase due to capacity reduction, causing bottlenecks (Westwood and Silvester 2007).

Greater Manchester Public Health Practice Units (2010) provided a set of dimensions, which extends the list of points to focus on when wanting to allocate resources, reported by ACP (2011). This approach can be used on an organisational or on a project level. It is a general set of dimensions, trying to tackle the barriers comprised by organisations focusing on costs and clinical effectiveness. The resource allocation is assessed against 13 dimensions, which are: savings, affordability, timing, need, benefits, likelihood of benefit, quality, innovation, efficiency, prevention, cost/benefit, fairness and inequality. These dimensions are further explained in Chapter 6.

5.3.6 Incentive System

The performance of employees is directly linked to incentives. They motivate, attract or improve the performance of employees, hence being an important tool that should not be neglected. They primarily come in the form of financial and non-financial incentives. Non-financial incentives include recognition of work, professional autonomy, planned career breaks and so forth (ICN 2008).

Examples for the influence of incentives on healthcare systems can be found throughout the literature. The NHS for example has seen a drastic reduction in LOS (length of stay) since 2006 thanks to incentives. An additional bed day reduced hospital revenue by £248.00, which encouraged hospitals to discharge patients more quickly (Cooper et al. 2010).

There is consensus throughout the literature that incentive systems should include financial as well as non-financial incentives, and consider intrinsic and extrinsic rewards. Physicians might choose to treat patients despite a cutback in

salary, because they enjoy helping people (intrinsic reward). However, when offered a job in administration with higher salary but no more treatment hours, they might choose the higher paid job (extrinsic reward). An incentive system should consider the differences and balance both.

As a consequence, the value of an incentive system stands and falls on well-defined goals and performance measurements. If both are lacking, the system will be inaccurate and misused. This can increase resistance. The resistance of healthcare professionals on the other hand has been proven to depend on incentives. As a rule of thumb, the less incentives in place, the higher resistance will be (Lluch 2011).

5.3.6.1 Barriers

Despite supporting evidence for the use of financial incentives, there is a growing group of healthcare professionals opposing them. They interpret it as an insult to their professionalism and think it will not change their opinion towards quality improvement (Taitz, Lee and Sequist 2011). Indeed, Marshall and Harrison (2005) have argued that there is no linear relationship between the size of an incentive and its impact. Physicians may not respond above a specific level of income as they are already satisfied with what they earn financially. In addition, financial incentives have been misused and misplaced in various situations. Misplaced incentives often occur when linked to fixed targets as departments/individuals with the highest baseline performance get rewarded "rather than those who demonstrated the greatest improvement" (Carey, Buchan and Sanson-Fischer 2009, p.42). Taitz, Lee and Sequist (2011) therefore reported that financial incentives should be used based on outcome measures rather than on process measures. Although a study conducted in the UK showed that financial incentives led to an increase in quality of care, it was reported that the improvements were not sustainable. Once the objectives were met, the pace of improvement was not sustained (Campbell et al. 2009).

A commonly reported barrier is the wrong use of incentives for specific situations. As Lean Six Sigma enhances and demands teamwork, incentives

should be adjusted to relate to the team's performance and outcome. Individual incentives are misplaced when team work is crucial for success (ICN 2008).

5.3.6.2 Ways to overcome barriers

The bad reputation of financial incentives has deep roots within healthcare professionalism. Studies have shown that financial incentives have contributed to improvement but also have failed to sustain improvement in many occasions. This might explain the negative attitude towards financial incentives. A major reason why financial incentives have failed to deliver and have a bad reputation is the wrong linkage of incentives to goals. Studies have repeatedly reported that the definitions of goals was either weak or other aspects were neglected, which led to incentives being either misused or being counter-productive. Hence, it can be concluded that before introducing an incentive system, a considerable amount of work should be spared on finding the right goals and considering different scenarios. If at first an incentive linked to a goal seems best, scenarios have to be considered wherein the incentive could be misused. This will lead to a transparent, fair and consistent incentive system.

5.3.7 Project Management

Project management literature reports a high number of projects failing (over 60%) due to multiple reasons. According to de Koning et al. (2006), projects fail because they are not of strategic relevance, they were not planned properly, continuous project tracking was missing or the project management procedures were not followed completely. By following project management procedures, common project pitfalls can be avoided, such as the size and definition of projects slowly growing beyond what is reasonable or lack of project resources (Fontaine 2007).

Being aware of the practicalities and procedures in project management is imperative for the successful completion of projects, which in turn is critical for the integration of LSS. Juran (2005) defined a project as a chronic problem that is scheduled for solution. Projects in the area of Lean Six Sigma are further classified in either quick wins or advanced. Quick wins refer to Lean projects,

and advanced are defined as Six Sigma projects. According to Iles and Sutherland (2001), projects consist of important features, such as an objective incorporating time, performance specification and cost, uniqueness (carried out once, temporary and multi-disciplinary team), resources and a beginning and an end. The self-evident statement that a project has a beginning and an end is often neglected. In fact, change management specialists such as Kotter or Strebel have reported project managers failing to close projects, hence the necessity of dedicating a whole section (step) in Kotter's 8 step model. Furthermore, the mentioned project features need to be focused upon and realised, which is where project management comes in.

Several certifications are provided to standardise project management procedures, like PRINCE2 or certifications from PMI. Nevertheless, project management follows a traditional approach of five stages: initiation, planning, execution, monitoring and control and closure. In addition, the stages (especially planning, execution, monitoring and control) are iterative, meaning that the earlier stages are informed by the later ones (Iles and Sutherland 2001).

LSS makes use of methodologies like PDCA and DMAIC. Both methods are used in healthcare to manage projects. They are often extended drastically to fit all project management procedures, such as incorporating project prioritisation and project team composition etc. (Tang et al. 2007).

5.3.7.1 Barriers

Project management barriers are reported in each of the five abovementioned stages. Chakravorty (2009) reported projects failing due to unavailability of data, objectives being unclear and the skipping of project management steps. As mentioned in Chapter 2, the NHS faces problems in their projects, as each of the DMAIC steps are not addressed properly. In fact, the initial steps (Define and Measure) - often regarded as requiring too much planning and less action - are neglected, and focus is shifted to the Improvement step, which is more action-oriented.

Kerzner (2009) reported many things that can impede the success of a project. Projects start with the initiation being part of the planning stage. This is due to the fact that organisations want to prevent project members getting frustrated, as the project does not seem to get started. Another reason is that organisations do not pay much importance to the initiation stage. Projects are prioritised based on reasons other than necessity, improvement and benefit potential. In addition, projects are tightly planned regarding time and resource allocation. Furthermore, the execution of projects is jeopardized by ignoring the importance of pilot projects. Kumar, Antony and Tiwari (2011) highlighted the importance of pilot projects, as they can act as a model for the organisation to follow. Next, Antony (2004) emphasised the need to track the progress of projects on a frequent basis. The deadline of a project gets extended as the progress is not monitored, resulting in high costs and influencing the project closure. As previously mentioned, managers fail to close projects and provide final feedback to project members. Kotter (1995) stated that there is a need to see the end of the road, meaning that projects have to end, be celebrated and reflected upon for a good learning experience.

Each barrier is influenced by the level of commitment that is put into each project management stage. Lewin, Schein or Strebel said that changing for the sake of change (improving for improvement's sake) is the wrong way to go. As commitment is grounded on this premise, projects will fail to sustain.

5.3.7.2 Ways to overcome barriers

A pilot study in UK service organisations conducted by Antony (2004) reported project management skills being under the top three factors that are critical to the success of Six Sigma projects. Whether the hospital decides to follow PRINCE2, PMBOK or other project management procedures is based on their own needs and preferences. It is imperative that the procedures are followed in sequence and with equal effort, not neglecting steps because they are difficult to handle. As a rule of thumb, five project management stages need to be considered:

(1) Project initiation - prioritising projects (consider information provided in "performance measurement" section, where prioritisation is made based on high risk, high volume and problem prone) and assigning the right team leader with the right set of skills.

(2) Project planning - defining resources that are needed to successfully complete the project, which will help to define quality and quantity of work. Finally, the creation of a detailed project plan is mandatory.

(3) Project execution - composing the project team with valuable members having direct experience with the process which has to be changed. Piloting the project to test and learn is next. The project manager has to direct and manage the work to keep an overview and be able to provide feedback.

(4) Project monitoring and control - tracking the progress of the project. This step is closely linked to the project plan and is usually included in the plan.

(5) Project closure - completing the project by celebrating the success. A final feedback will be provided after reflecting upon the results.

5.3.8 Sense of Urgency

The terminology "sense of urgency" can be dated back to the 1990s, when Kotter used it in the context of change management. According to Kotter (1995), the success of changing an organisation depends on management being convinced that business as usual is not acceptable. He even provided a minimum percentage of management (75%) that needs to be convinced. In order to convince management, they have to be made aware of the difference between how ways are now and how ways should be. This can be brought to light through an open and honest dialogue about urgent matters. It is however imperative that the urgent matters brought up in the dialogue are supported by quantitative data. This can mean the difference between real urgency and artificial urgency. Kotter explained that numbers have a stronger influence on how people perceive a situation and will strengthen their sense of urgency.

5.3.8.1 Barriers

The existing barriers for creating sense of urgency are few but substantial. An imminent barrier is complacency. Organisations find it difficult to motivate staff to the extent whereby they feel the need to collectively drive change. Creating a sense of urgency demands that the actual situation is reported as existence-threatening for the organisation, and that it is necessary to change. This involves the danger that staff will feel too much pressure and either surrender or not be motivated to work efficiently. At the same time, management can feel paralyzed by the staff's drop of morale, uncontrolled events, jeopardized short-term results and high responsibility. According to Kotter (1995), the phenomenon described above occurs when there are too many managers and not enough leaders. Complacency also occurs where management does not keep what they promise. Hence, Kotter suggested that management keep their word and behave with urgency every day. Doing this continuously has been argued to be critical for successful change efforts. Management cannot stop communicating the sense of urgency without risking the success of their organisation change efforts (Fontaine 2007).

In addition, Kotter (2008) argued that quantifying sense of urgency is imperative. In fact, many failed change efforts have neglected looking at their market position or their performance and translated it in a statement to create a sense of urgency. Furthermore, he argued that creating a crisis by exposing issues rather than protecting the organisation from them has proven to be beneficial. In some cases, CEOs deliberately drove their organisation into a crisis in order to prove how important change was to their staff. Kotter (1995) argued that despite these measures being extremely risky, there is also high risk in managing the actual situation too safely.

5.3.8.2 Ways to overcome barriers

Complacency can be tackled in different ways. However, the success depends on how frequent sense of urgency was communicated and if management followed what they demanded from staff. It is important that all know about the unpleasant facts and serious consequences related to business as usual. Kotter

(1995) therefore highlighted the need for management to check the organisation's market position and performance. This allows the provision of quantifiable evidence that business as usual is not acceptable. From a healthcare perspective, organisations' performance could be reported from a financial and national (comparative) point of view. The latter is an indicator often used in healthcare to measure the performance of a hospital. In the UK, the NHS provides national performance indicators through the Hospital Episode Statistics, which is a data warehouse listing all admissions to NHS hospitals.

Kotter (2008) further provided four measures that can be taken to create a sense of urgency. First, it is necessary to create a crisis in order to guarantee the participation of staff, which can be done by bringing the outside in. Openly communicating the issues of the organisation with the media is a good start. Second, management has to keep their word and behave with urgency every day. Management showing signs of complacency cannot expect their employees to be convinced that business as usual is bad. Next, management is motivated to find opportunities in crisis. A crisis is not seen as a threat but as an opportunity to destabilize a stable organisation. It is important to note that the destabilisation of an organisation should be done in a controlled way, hence management already have an idea of how to tackle the issues. Otherwise it would result in "the sort of running-around behaviour associated with a false sense of urgency" (Kotter 2008, p.59). Lastly, management should deal with so called "NoNos", which is related to the attitude of staff. Staff blocking change or being determined to keep group complacency have to be dealt with and, when necessary, leave the company.

Finally, organisations can make sure whether they have a real sense of urgency by checking if management is convinced that business as usual is unacceptable. For this purpose, Kotter summed up his experience of over 1000 change projects and reported that over 75% of management should feel the sense of urgency for successful change efforts.

5.3.9 Understanding of processes

In healthcare, a frequently discussed topic is the patient-centred process. The management of processes considers an organisation to be viewed as a system of processes. It includes defining and mapping processes and identifying and improving bottlenecks (Hellstroem, Lifvergren and Johan Quist 2010). The process management of a patient centred process follows a pull approach, whereby the patient moves along a pathway until being discharged. It is a shift from the traditional departmental point of view to a process view. Patients typically has to go through different departments depending on their treatment needs, and along the way they are generally asked the same questions several times, and have to follow each department's rules and mores (Young and McClean 2008). This is not in the spirit of Lean, whereby waste is eliminated and processes become faster, hence the debate about using a more patient-centred approach in healthcare. This is easier said than done, as the major difference between manufacturing and hospitals is the latter's focus on people and not products. The treatment needs of each patient are different, making the design of processes highly complicated. Understanding processes is imperative to know how business works and how it can be improved. For example, some professionals have argued that despite each person having different needs, it is possible to categorise patients, as most processes have similarities.

Jones and Filochowski (2006) emphasised that hospital staff need to understand the process they are involved in to the extent that they can see opportunities for streamlining them. Knowing the principles of Lean helps understanding the processes as a system, and provides tools to streamline processes. The nature of Lean is questioning the existence of a process; in so doing, staff will come to the root of a process and have a complete understanding of it (i.e. the 5 Whys). Jones and Filochowski (2006) further highlighted that the reason why hospitals fail to improve is often because they partially redesign processes; by eliminating some blockages they create other blockages elsewhere (e.g. a patient gets out of A&E fast, but then has to wait too long for ward rounds or operating theatre time). This is caused by not

considering the whole picture (process), therefore not understanding how the process works.

5.3.9.1 Barriers

Jones and Filochowski cautioned against a traditional top-down approach regarding improving the understanding of processes. At the core of each process are the nurses and physicians, who have to understand how the process works, including administrative steps as well as clinical ones. This is necessary in order to improve the quality of care. They argued that in case a top-down approach is selected, the process understanding will shift the focus away from quality of care to the traditional cost-removal focus. A traditional cost-removal focus inhibits the understanding of the whole process and pays attention where costs can directly be removed (e.g. time a physician can spend with a patient is cut due to cost focus, jeopardizing the quality of care).

Another barrier is complacency when observing processes. To understand a process it is imperative to go to the gemba (the place where the work is done) and observe the process. Understanding a process needs patience, communication skills and observation skills (Carleysmith, Dufton, and Altria 2009). Relying on reports or old flow charts results in a distorted picture between reality and hearsay.

Finally, Proudlove, Moxham and Boaden (2008) reported that it is challenging to identify processes that contribute to the value stream in healthcare. The nature of hospitals is "silo" oriented, meaning that groups (departments) are encapsulated from each other, having their own information flow or rules. This makes it challenging to define target processes, as processes go through different departments.

5.3.9.2 Ways to overcome barriers

There are different ways to enhance the understanding of processes. Tools such as VSM or simple process mapping and 5 whys support staff to understand how their processes work from start to finish. It is not advisable to

use a top-down or bottom-up approach, as everyone should be involved in the process. A top-down approach would focus on cost removal and neglect quality of care, while a bottom-up approach would neglect costs, both of which are important. Therefore, staff should be introduced in the elements of a process in order to obtain a common understanding of what a process is. The elements of a process are defined as purpose, scope, input, output and controls of the process. The structured approach of these elements enhances the understanding of a process (DTI no Date).

In addition, going to the gemba and obtaining first-hand information has been considered mandatory. In order to do so, observational skills are needed in conjunction with good communication skills.

5.3.10 Clear Goals

Edwin Locke and Gary Latham are considered to be the pioneers of goal theory, which dates back to the 1960s. Locke discovered a correlation between the clarity and difficulty of a goal and people's performance of a task. According to his studies, clear and challenging goals led to an increase in performance compared to unclear and easy to achieve goals. It became clear to him that goals which lack challenge inhibit the increase in performance, and hence are not a motivational force. Nevertheless, both researchers realised that achieving a goal was not only dependent on a single factor. Empirical studies showed that there were influential factors other than challenging goals (Heslin, Carson and Vandevallie 2009). Beside goals being challenging, they should also have a high level of clarity, commitment, task complexity and feedback (Locke and Latham 2002).

Defining clear goals is a crucial task that has been proven to have a significant influence on task performance. As Lean and Six Sigma are performance improvement techniques, they built on aggressive established goals for quality improvement. Therefore, one would assume that defining goals in Lean and Six Sigma is done in an accurate way. In fact, a case conducted in a manufacturing firm reported that goals were accurately defined as long as Six Sigma tools and methods were strictly adhered to (Langabeer et al. 2009). Langabeer et al.

further reported that in healthcare, less than 20% of projects (published in literature from 1998-2008) stated a goal in advance of project initiation. The majority of those who did defined goals in qualitative terms rather than in an appropriate quantitative form. This leads to questioning the efficiency of implemented LSS projects, as quantified goals and the measurement of value constitute the foundation of LSS.

Prior to the initiation of projects, quantitative goals need to be set and be consistent with organisational goals. Anand et al. (2009) stated that in doing so, project teams must be responsible for attaining those goals. They explained that goals are often set too low in order for the teams to attain and even surpass them, and in case of not attaining the goal they are not held accountable.

5.3.10.1 Barriers

Bahensky, Roe and Bolton (2005) reported a case wherein an intensive Kaizen event took place to eliminate non-value added activities. On the onset of this Kaizen event, top management established a goal, which was quantitative. In addition, performance measurements were set in order to achieve the goal. The interaction between setting goals and performance measurements takes place in every project and needs to be addressed accordingly. This means defining goals in a quantitative manner demands performance measurements in place. It is difficult to address the achievement of a goal if performance measurements are missing. Hence, the first barrier faced when defining goals is the lack of performance measurements, which is coherent with the difficulty of expressing goals in a quantitative way. Failure of expressing goals in a quantitative way can lead to ambiguous goals (Locke and Latham 2006).

Many researchers have stated the importance of linking project goals to organisational (strategic) goals. This is especially difficult in healthcare, because of the complexity of treatments or the amount of multiple stakeholders. The interrelationships among multiple stakeholders (internal and external) particularly add further complexity, as goals have to satisfy the needs and interests of many stakeholders with different ideas. This has led healthcare to develop rather broader than specific goals over years, which according to Adair,

Simpson and Casebeer (2006) cannot be changed easily. Adair, Simpson and Casebeer further suggested that management needs to commit to defining goals, which coincides with the research outcome of Locke and Latham (2002). Commitment to define goals means to involve staff in establishing goals; this however does not mean that goals need to be overly negotiated and approved by staff. The thin line between committing to defining goals and wasting time and energy over-discussing everything symbolises the healthcare environment.

Easy to achieve goals represent an additional barrier to defining efficient goals. According to Locke and Latham (2002) and Heslin, Carson and Vandevall (2009), goals have to be challengeable to achieve. Only then will staff be highly motivated, as working towards the goal has an important meaning. Herein lies the difficulty of knowing how hard a goal can be without demoralising staff. The phenomenon of setting easily achievable goals exists throughout industries, often in form of growth percentages or ROI, whereby targets are set so that they can be surpassed or easily achieved.

Carey, Buchan and Sanson-Fisher (2009) reported the importance of existing feedback, which is an effective tool to improve care. It allows goals to be refined or detect barriers that may hinder goal attainment.

5.3.10.2 Ways to overcome barriers

Many researchers contributed to the goal-setting theory by addressing the definition of goals and their impact on tasks. Locke and Latham's (2002, 2006) work has to be highlighted, as it was (and is) used as the foundation for further research. In addition, professionals emphasise the importance of focusing on goals. According to Locke and Latham only a few elements are considered. Throughout literature the most common goal attributes mentioned are measurable goals and commitment towards goals. Only a few mention the importance of challenging goals. In fact, quick wins that are important to keep up the motivation of staff are wrongly considered equal to creating easy to achieve goals. Kotter emphasised the importance of quick wins and clearly stated that management needs to look out for processes, which have a lot of waste and can be tackled. This should be done in the first six months of a

change initiative, to keep staff motivated and convince those doubting or resisting. Nevertheless, looking out for quick wins is done in the initial phase of a change project and becomes less possible and important with time passing by. Hence, looking for quick wins should not be equivalent to creating easy goals.

The last two attributes reported by Locke and Latham (2002) are often mentioned in combination with project management. Task complexity and feedback are two elements which are seldom linked to the setting of goals. However, Locke and Latham stated that in order to achieve challenging goals it is imperative to assess the task complexity and break it into manageable tasks. Furthermore, they argued that for goals to be effective "people need summary feedback that reveals progress in relation to their goals" (Locke and Latham 2002, p.708). Feedback has to be continuous and can be expressed through discussions or through progress signals. It is common in manufacturing to provide progress on digital tables indicating the production goal for the day and the actual production outcome. This form of feedback has no use in healthcare due to its unpredictable nature. In healthcare, progress can be measured and feedback can be provided by making use of performance measurements. The NHS already has extensive experience with the use of Balance Scorecard, which is also used to inform staff on their progress (Patel, Chausalet and Millard 2008).

In sum, when defining goals, organisations should consider five attributes, namely that goals: be measureable and unambiguous, be challenging, inspire commitment, have some complexity and are guided by feedback (Locke and Latham 2002).

5.3.11 Performance Measurement

The nature of performance measurements is to assess the performance of processes. They are accompanied by the need to drive improvement in many ways, such as "improving communication between administrative and clinical leadership" or "defining and targeting gaps in patient safety and variations from the standard of care that can help identify areas for improvement" (Joint

Commission Resources 2008a, p.8). In healthcare, performance measurements have traditionally focused on operational management and finances. Therefore, they had little relevance to clinical professionals or users of health services. Using performance measurements to assess the outcomes of care is highly relevant and involves clinical professionals and users of health services (Walburg et al. 2006).

In recent years, organisations such as the Joint Commission on Accreditation of Healthcare Organisations (JCAHQ) and the Agency for Healthcare Research and Quality (AHRQ) have developed extensive performance measurement databases. JCAHQ (over 1,000 measures) and AHRQ (around 1200 measures) have been working on standardising measures, as comparative reporting would not be possible unless the measures were commonly defined (Adair, Simpson and Casebeer 2006). Although these databases are filled with measures, healthcare organisations have to select or develop measures relating to their own needs. In order to develop performance measurements, it is imperative to consider what type of data needs to be collected. Data types in healthcare can be categorised in four dimensions: clinical, perceptions of care or patient satisfaction data, financial data and employee satisfaction data. Based on the needs of an organisation, specific types of data are collected. In case of understanding the turnaround time in the operating room (OR), specific data should be gathered regarding the timeliness of patient preparation, OR readiness, surgeon start time, equipment reliability, readiness of appropriate ancillary staff members and availability of necessary documentation (Joint Commission Resources 2008a).

Organisations have made use of several frameworks to support them as their performance measurement system. The most known framework is the Balance Scorecard (BSC) by Kaplan and Norton (Metawie and Gilman 2005). It is a management system, which supports organisations in specifying their vision and strategy resulting in clear objectives and measures. BSC has been widely applied in manufacturing companies, whose focus lies in profit and competition, whereas in public sector organisations, the focus lies on mission and passion (Yeung and Connell 2006). The BSC has attracted a lot of attention from healthcare organisations. In case of the NHS, the BSC enables the Healthcare

Commission in its monitoring work at an organisation-wide level. Furthermore, the NHS developed its own BSC composed of three dimensions (compared to the four dimensions of a traditional BSC). The NHS BSC relies on measures from patient focus, clinical focus and capability/capacity focus (Grigoroudis, Orfanoudaki and Zopounidis 2011). Since the development of the NHS BSC in 2001 many performance measure have been added. From 2001/2002 to 2002/2003 alone, 17 performance measures have been evaluated and added to NHS BSC (Patel, Chaussalet and Millard 2008).

5.3.11.1 Barriers

Creating and handling performance measurements is a difficult process, all the more so considering the complexity of organisations in healthcare and their relationship with performance measurements. The most common barrier healthcare organisations face is the low amount of available measures and their relevance. The relevance of measures is frequently underestimated and, according to Adair, Simpson and Casebeer (2006), it seems that once collected they are rarely deleted. This indicates that healthcare organisations operate with antiquated and inefficient performance measurements.

Furthermore, Smith and Goddard (2002) report organisations being opportunistic and preferring measures that are already available to newer and more important measures. There is less focus on what type of performance measurement is needed and its relevance to the organisation's strategic objectives. Hence performance measurements are created for the sake of measuring.

Finally, Adair, Simpson and Casebeer (2006) reported that healthcare organisations define performance measurements without considering factors which are hazardous to the creation of measurements. Goddard et al. (2002) reported potential hazards in performance measurement such as tunnel vision, sub-optimisation and myopia. The success of improvement depends critically on the extent to which these potential hazards are dealt with. They further argue that organisations - despite being successful in creating performance

measurements - will face these hazards and immediately need to address them in order to obtain a good and relevant measure.

5.3.11.2 Ways to overcome barriers

Clarifying the type of data of a performance measurement is an important process in order to balance the availability of measurements. Performance measurements in healthcare have traditionally focused on the financial aspects as it was easier to obtain measures. However, healthcare organisations have categorised performance measurement in four dimensions: clinical perceptions of care or patient satisfaction data, financial data and employee satisfaction data. These dimensions cover all possible areas regarding performance measurements in a hospital. In order to prevent the existence of needless measures and enhance relevance to the overall strategic objectives it is therefore necessary to concentrate on what type of data is needed.

After clarifying the type of data of a performance measurement, deciding what specifically to measure comes next. The Joint Commission (2008b) recommended prioritising the choice of measurements selection according to three characteristics: high-risk, high-volume and problem-prone areas:

- High-risk areas are highly vulnerable, unstable or fragile.
- High-volume refers to services that are offered frequently or to a large population.
- Problem-prone refers to processes or procedures that have historically produced bad results.

The prioritisation step brings a structured approach in defining performance measurements and reduces confusion. In case the organisation still faces difficulties in creating performance measurements, the Joint Commission (2008b) recommends looking for populations or performances, which have overlapping characteristics (e.g. processes that have a high-risk and are problem-prone).

Finally, organisations should be aware of hazards impeding good performance measurements and should find ways overcoming the hazards. The hazards that should be considered are:

- Tunnel vision
- Sub-optimisation
- Myopia
- Complacency
- Measure fixation
- Misinterpretation
- Gaming
- Ossification

(Examples and definitions to each of the hazards are provided in Appendix B).

5.4 Relationship and Sequence Between CSFs

All mentioned CSFs have a strong relationship with each other. Some links are stronger and some weaker. The secondary analysis indicated that some CSFs depend on and drive each other. Some CSFs can only be realised if other CSFs are addressed, which indicates the existence of a sequence, meaning some CSFs have to be addressed prior to others. The sequencing and analysis of the relationship between each CSF for sustainable LSS is a major contribution to operations management. As this research used the Interpretive Structural Modelling method by involving researchers and healthcare professionals, the results are also useful for healthcare professionals. Knowing how each CSF is linked to others allows the specific handling of CSFs and helps avoiding negative chain reactions.

5.4.1 Interpretive Structural Modelling

The goal and applicability of ISM was already discussed in detail in Chapter 3. In short: ISM provides structure within a system of complex relationships. A group of 10 experts in the area of Lean Six Sigma provided the necessary input. The number of experts and procedure in obtaining the model coincides with other ISM studies (Singh and Kant 2008, Sagheer, Yadav and Deshmukh 2009, Pramod and Banwet 2010, Salimifard, Abbaszadeh and Ghorbanpur 2010, Talib, Rahman and Qureshi 2011). The participating experts have 5 years of experience on average and have a healthcare (n=7), research (n=2) and government (n=1) background. The final model was obtained by following nine steps as shown in 5.4.2.

5.4.2 Data Analysis

STEP 1) The 11 CSFs were listed as CSFs a-k and were identified through literature review and discussion with experts of the relevant area (Table 5.3).

a)	Top management commitment
b)	Clear vision
c)	Clear goals
d)	Training/education
e)	Communication at all levels
f)	Resources
g)	Incentive-system
h)	Project management
i)	Sense of urgency
j)	Understanding of processes
k)	Performance measurement

Table 5.3 - Critical Success Factors for Sustainable Lean Six Sigma

STEP 2) CSFs identified in the first step were arranged in rows and columns, displaying a matrix wherein each CSF was related with the other one by one, pair-wise, through rows and columns. The contextual relationship "will help achieve" was established among CSFs in terms of "V", "A", "X", and "O".

"V", "A", "X", and "O" were used to denote the direction of the relationship between the factors 1 and 2.

- 1) **V** - is used if factor 1 "will help achieve" factor 2.
- 2) **A** - is used if factor 2 "will help achieve" factor 1.
- 3) **X** - is used if factor 1 and 2 "help achieve each other".
- 4) **O** - is used if factor 1 and 2 are unrelated.

STEP 3) On the basis of pair-wise relationship between CSFs of the system a structural self-interaction matrix (SSIM) is developed (Table 5.4).

Factor 1 \ Factor 2	a	b	c	d	e	f	g	h	i	j	k
a) Top management commitment		A	V	V	V	V	V	V	A	V	V
b) Clear vision			V	V	V	V	V	V	0	V	V
c) Clear goals				V	0	V	V	V	0	A	A
d) Training/education					V	A	0	V	A	V	0
e) Communication at all levels						0	0	V	A	X	V
f) Resources							V	V	A	V	0
g) Incentive system								V	A	V	0
h) Project management									0	0	A
i) Sense of urgency										V	V
j) Understanding of processes											V
k) Performance measurement											

Table 5.4 - Structural Self-Interaction Matrix (SSIM)

The SSIM illustrated in Table 5.4 was developed according to the output of the experts. The factors were arranged in a matrix in order to allow a pair-wise comparison.

STEP 4) A reachability matrix is then developed from the SSIM by converting the information in each cell into binary numbers "1" and "0" and thus, an initial reachability matrix is constructed (Table 5.5).

Factor 1 \ Factor 2	V	A	V	A	V	A	V	A	V	A	V
a) Top management commitment	1	0	1	1	1	1	1	1	0	1	1
b) Clear vision	1	1	1	1	1	1	1	1	0	1	1
c) Clear goals	0	0	1	1	0	1	1	1	0	0	0
d) Training/education	0	0	0	1	1	0	0	1	0	1	0
e) Communication at all levels	0	0	0	0	1	0	0	1	0	1	1
f) Resources	0	0	0	1	0	1	1	1	0	1	0
g) Incentive system	0	0	0	0	0	0	1	1	0	1	0
h) Project management	0	0	0	0	0	0	0	1	0	0	0
i) Sense of urgency	1	0	0	1	1	1	1	0	1	1	1
j) Understanding of processes	0	0	1	0	1	0	0	0	0	1	1
k) Performance measurement	0	0	1	0	0	0	0	1	0	0	1

Table 5.5 - Initial Reachability Matrix

To develop the initial reachability matrix from the SSIM, the denotations V, A, X, O were coded into binary digits as follows:

- If "V" was assigned to the cell (factor1, factor2) then the cell was coded with "1" and the cell (factor2, factor1) was assigned "0".
- If "A" was assigned to the cell (factor1, factor2) then the cell was coded with "0" and the cell (factor2, factor1) was assigned "1".
- If "X" was assigned to the cell (factor1, factor2) then the cell was coded with "1" and the cell (factor2, factor1) was assigned "1".
- If "O" was assigned to the cell (factor1, factor2) then the cell was coded with "0" and the cell (factor2, factor1) was assigned "0".

STEP 5) The initial matrix obtained from STEP (4) is checked for transitivity and modified if necessary. The transitivity of the contextual relation is a basic assumption made in ISM. It states that if a CSF “i” is related to “j”, and “j” is related to “k”, then “i” is necessarily related to “k”. Relationships which were analysed as transitive but not marked from the participants were highlighted by the researcher with ^t. Thus, a final reachability matrix is obtained (Table 5.6).

Factor 1 \ Factor 2	a)	b)	c)	d)	e)	f)	g)	h)	i)	j)	k)	Driving Power
a) Top management commitment	1	0	1	1	1	1	1	1	0	1	1	9
b) Clear vision	1	1	1	1	1	1	1	1	0	1	1	10
c) Clear goals	0	0	1	1	1 ^t	1	1	1	0	1 ^t	1 ^t	8
d) Training/education	0	0	1 ^t	1	1	0	0	1	0	1	1 ^t	6
e) Communication at all levels	0	0	1 ^t	0	1	0	0	1	0	1	1	5
f) Resources	0	0	1 ^t	1	1 ^t	1	1	1	0	1	1 ^t	8
g) Incentive system	0	0	1 ^t	0	1 ^t	0	1	1	0	1	1 ^t	6
h) Project management	0	0	0	0	0	0	0	1	0	0	0	1
i) Sense of urgency	1	0	1 ^t	1	1	1	1	1 ^t	1	1	1	10
j) Understanding of processes	0	0	1	1 ^t	1	1 ^t	1 ^t	1 ^t	0	1	1	8
k) Performance measurement	0	0	1	1 ^t	0	1 ^t	1 ^t	1	0	0	1	6
Dependence Power	3	1	10	8	9	7	8	11	1	9	10	

Table 5.6 - Final Reachability Matrix

STEP 6) The final reachability matrix is partitioned into different levels on the basis of the intersection set $(R(F_i) \cap A(F_i))$ of the reachability $(R(F_i))$ and antecedents sets $(A(F_i))$ for each of the CSFs and through a series of iterations (Tables 5.7-5.13).

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(F_i) \cap A(F_i)$	Level
a	a,c,d,e,f,g,h,j,k	a,b,i	a	
b	a,b,c,d,e,f,g,h,j,k	b	b	
c	c,d,e,f,g,h,j,k	a,b,c,d,e,f,g,i,j,k	c,d,e,f,g,j,k	
d	c,d,e,h,j,k	a,b,c,d,f,i,j,k	c,d,j,k	
e	c,e,h,j,k	a,b,c,d,e,f,g,i,j	c,e,j	
f	c,d,e,f,g,h,j,k	a,b,c,f,i,j,k	c,f,j,k	
g	c,e,g,h,j,k	a,b,c,f,g,i,j,k	c,g,j,k	
h	h	a,b,c,d,e,f,g,h,i,j,k	h	I
i	a,c,d,e,f,g,h,i,j,k	i	i	
j	c,d,e,f,g,h,j,k	a,b,c,d,e,f,g,i,j	c,d,e,f,g,j	
k	c,d,f,g,h,k	a,b,c,d,e,f,g,i,j,k	c,d,f,g,k	

Table 5.7 - First Iteration for Level I

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(F_i) \cap A(F_i)$	Level
a	a,c,d,e,f,g,j,k	a,b,i	a	
b	a,b,c,d,e,f,g,j,k	b	b	
c	c,d,e,f,g,j,k	a,b,c,d,e,f,g,i,j,k	c,d,e,f,g,j,k	II
d	c,d,e,j,k	a,b,c,d,f,i,j,k	c,d,j,k	
e	c,e,j,k	a,b,c,d,e,f,g,i,j	c,e,j	
f	c,d,e,f,g,j,k	a,b,c,f,i,j,k	c,f,j,k	
g	c,e,g,j,k	a,b,c,f,g,i,j,k	c,g,j,k	
i	a,c,d,e,f,g,i,j,k	i	i	
j	c,d,e,f,g,j,k	a,b,c,d,e,f,g,i,j	c,d,e,f,g,j	
k	c,d,f,g,k	a,b,c,d,e,f,g,i,j,k	c,d,f,g,k	II

Table 5.8 - Second Iteration for Level II

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(F_i) \cap A(F_i)$	Level
a	a,d,e,f,g,j	a,b,i	a	
b	a,b,d,e,f,g,j	b	b	
d	d,e,j	a,b,d,f,i,j	d,j	
e	e,j	a,b,d,e,f,g,i,j	e,j	III
f	d,e,f,g,j	a,b,f,i,j	f,j	
g	e,g,j	a,b,f,g,i,j	g,j	
i	a,d,e,f,g,i,j	i	i	
j	d,e,f,g,j	a,b,d,e,f,g,i,j	d,e,f,g,j	III

Table 5.9 - Third Iteration for Level III

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(Fi) \cap A(Fi)$	Level
a	a,d,f,g	a,b,i	a	
b	a,b,d,f,g	b	b	
d	d	a,b,d,f,i	d	IV
f	d,f,g	a,b,f,i	f	
g	g	a,b,f,g,i	g	IV
i	a,d,f,g,i	i	i	

Table 5.10 - Fourth Iteration for Level IV

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(Fi) \cap A(Fi)$	Level
a	a,f	a,b,i	a	
b	a,b,f	b	b	
f	f	a,b,f,i	f	V
i	a,f,i	i	i	

Table 5.11 - Fifth Iteration for Level V

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(Fi) \cap A(Fi)$	Level
a	a	a,b,i	a	VI
b	a,b	b	b	
i	a,i	i	i	

Table 5.12 - Sixth Iteration for Level VI

Factor (Fi)	Reachability set R(Fi)	Antecedent set A(Fi)	Intersection set $R(Fi) \cap A(Fi)$	Level
b	b	b	b	VII
i	i	i	i	VII

Table 5.13 - Seventh Iteration for Level VII

$R(Fi)$ for a particular factor consists of the factor itself and the other factors, which it may help achieve. Similarly, $A(Fi)$ consists of the factor itself and the other factor which may help in achieving them. If for any factor the condition $R(Fi) = R(Fi) \cap A(Fi)$ is met, the factor is given the top level in the ISM hierarchy, meaning that it does not help achieve any other factors above their own level. The top-level factor(s) is/are then removed from the remaining factors. This iteration is continued until the levels of each factor are determined.

STEP 7) On the basis of the level partitions and the final reachability matrix, a conical matrix (lower triangular matrix) is constructed (Table 5.14).

<div>Factor 2</div> <div>Factor 1</div>	h) Effective project management	k) Good performance measurements	c) Clearly defined goals	e) Good communication on all levels	j) Understanding of processes	g) Incentive (financial or motivational)	d) Effective training/education	f) Resource availability	a) Top management commitment	b) Clear vision	i) High sense of urgency
h) Effective project management	1	0	0	0	0	0	0	0	0	0	0
k) Good performance measurements	1	1	1	0	0	1	1	1	0	0	0
c) Clearly defined goals	1	1	1	1	1	1	1	1	0	0	0
e) Good communication on all levels	1	1	1	1	1	0	0	0	0	0	0
j) Understanding of processes	1	1	1	1	1	1	1	1	0	0	0
g) Incentive (financial or motivational)	1	1	1	1	1	1	0	0	0	0	0
d) Effective training/education	1	1	1	1	1	0	1	0	0	0	0
f) Resource availability	1	1	1	1	1	1	1	1	0	0	0
a) Top management commitment	1	1	1	1	1	1	1	1	1	0	0
b) Clear vision	1	1	1	1	1	1	1	1	1	1	0
i) High sense of urgency	1	1	1	1	1	1	1	1	1	0	1

Table 5.14 - Conical Matrix

STEP 8) A structural model is generated with the information from the conical matrix to present the results geographically (Figure 5.1).

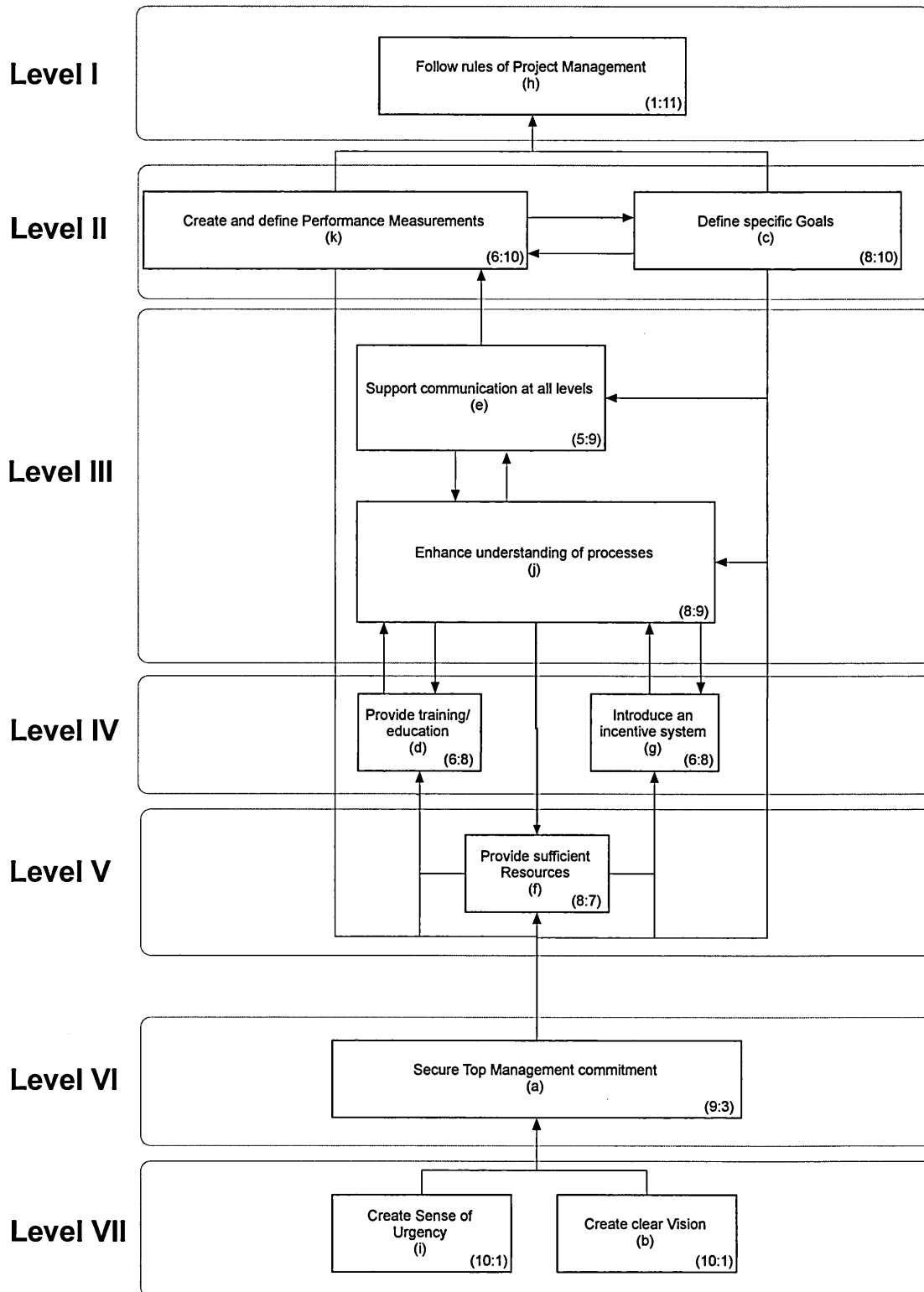


Figure 5.1 - The ISM of Sustainable LSS CSFs

STEP 9) Finally, the ISM model developed is reviewed to check for conceptual inconsistency and necessary modifications are incorporated through expert opinions.

5.4.3 Results and Discussion

"Matrices d'impacts croises - multiplication applique a un classement" stands for MICMAC and was developed by Duperrin and Godet. The analysis allows exploring the influence and dependence between factors and categorises them into four clusters: autonomous, dependent, linkage and independent factors. From the Reachability matrix, the driving power and dependence power are obtained and each factor is plotted as points using conventional x-y coordinate system. The result is shown in Figure 5.2.

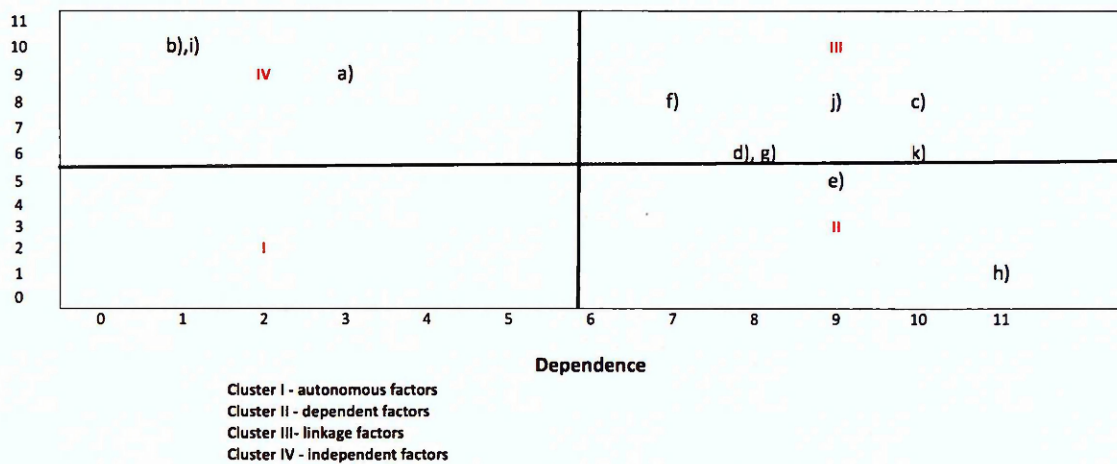


Figure 5.2 - MICMAC Analysis

Cluster I represents the *autonomous* factors. These factors are considered to be disconnected from the whole system as they only have a few links with other factors. They are characterised by weak driving power and weak dependence. No autonomous factors were detected from the set of CSFs, which indicates a clear defined set of factors without redundant or unimportant factors. The results illustrate the complex interrelationship of the CSFs with no factors being disconnected from others. This brings light to the fact that all considered CSFs influence the sustainability of LSS in hospitals.

Factors in cluster II are *dependent* as they have relatively high dependence but low driving power. This cluster represents the exit of the system and is illustrated as the last factor in the ISM. Project management was found to be highly dependent, resulting in a max score of 1:11, meaning that all factors influence it. It therefore represents the weakest of all eleven factors, and if focused on will not have a direct influence on the sustainability of LSS.

Next is cluster III which represents *linkage* factors. They are characterised by strong driving power and strong dependence power. Those types of factors are unstable in the sense that any influence on these factors will have an effect on other factors. It is observed that the majority of CSFs are distributed in this cluster, hence being of unstable nature. This does not imply that the whole system is unstable, but provides information about the level of attention that management should provide in order to sustain LSS. Attention should be paid to training/education, communication at all levels, resources, incentive-system, sense of urgency, understanding of process and performance measurement. These factors have high influence on the system and are also highly dependent on other factors. The low dispersion of the CSFs illustrated in figure 5.2 indicates that these factors are a system-in-system (sub-system). As can be observed from figure 5.1, these linkage factors have strong links to each other, despite being on different levels (indicated by arrows going in the opposite direction from Level II to Level V, representing the sub-system). All factors in cluster III, besides resources, are more dependent than driving. Resources has an influence on all factors in Level IV, Level III, Level II and Level I, and therefore can be highlighted as most unstable factor among the sub-system. In case the factors in Level VI and Level VII are addressed and complied with, resources should be focused on next. Failure to do so will result in a system breakdown. Additionally, understanding of processes and clear goals have driving power equal to resources, but higher dependence, thus they have to be addressed with care. Without the understanding of processes and clear defined goals, the provision of training/education, resources, the incentive system, the support for communication at all levels, the creation of performance measurements and the right project management skills are jeopardised. Training/education and incentive system have an influence on all factors from

Level III to I with exception of resources. They have been found to be dependent on the successful use of resources but not vice versa. Hence, the provision of training/education and the use of an incentive system will not help achieve the allocation of sufficient resources. Communication at all levels was detected as the weakest link in the sub-system, with the lowest driving power. The absence of communication at all levels will not directly influence the provision of training/education, allocation of resources or the use of an incentive system, but it will have an impact on the definition of clear goals, the creation of clear performance measurements or the understanding of processes. Considering the strong links between these factors, it becomes evident that any action on linkage factors has consequences on other factors. These consequences can have a boomerang effect, which can amplify or forestall the integration of LSS.

Finally, cluster IV includes the *independent* factors, with weak dependence power but strong driving power. These factors are considered as the beginning of the system. The independent factors include top management commitment, clear vision and sense of urgency. Sense of urgency and clear vision represent strong factors that influence every factor in the system, excluding each other. It has been observed that there is no relationship between the sense of urgency and a clear vision. There is no factor influencing them, hence both factors represent the main driving power of the whole system. In case one of the pair is neglected, the integration of LSS cannot take place. A third (weaker) driving power is represented by top management commitment. It has the power to drive the whole system, provided that sense of urgency and clear vision are in place. As a result, the independent factors represented by cluster IV are necessary conditions for the successful integration of LSS in hospitals.

The analysed results are based on a threshold at $p=0.5$, which was set as a condition before performing the ISM analyses. It is feasible to question the choice of threshold. However, the researcher chose $p=0.5$ to signal that only the majority vote is considered. A single case exists where two options had the same p value. The relationship between effective project management (h) and high sense of urgency (i) had $p=0.5$ at option A and O. Therefore, the

relationship was regarded as $p < 0.5$ and set to 0, because no choice could be made.

For a detailed analysis the threshold was shifted in 0.1 steps in both directions and analysed with MICMAC (see Appendix C). What becomes apparent is that three groups of factors are formed. The group with the most factors thereby shifts from cluster III towards cluster IV with increasing p value. At $p = 0.7$ the group has settled in cluster IV representing autonomous factors. It can be concluded that at $p \geq 0.7$ the majority of factors are disconnected from the whole system, and therefore have no relationship between each other. The other groups are stable and stay together and in their cluster. As the system is based on a sample of $n = 10$, a shifting of 0.1 outside of the range between $p = 0.4$ and $p = 0.7$ does not generate more insight. With lower p value the factors will merge together. With higher p value the factors will merge together towards cluster IV being autonomous. Hence, the main conclusion that can be drawn from the MICMAC analysis is that the factors build three groups regarding the threshold range 0.4-0.7.

The results stand in contrast to the frequency with which the CSFs are mentioned in previous literature. For instance, sense of urgency is only mentioned by a single source, but it obtained the highest score together with vision. By merging together the sources with LSS background with change management sources this fact becomes clearer, as in change management sources sense of urgency is reported as very crucial for the change of an organisation. This fact contributes further to the importance of this research, as it seems that sources with an LSS background neglect the fact that creating a sense of urgency is critical for the successful sustaining LSS.

5.5 Conclusion

This chapter presented and discussed 11 CSFs for the integration of LSS. These CSFs were identified through an extensive literature review, including only sources which addressed LSS from a healthcare or non-specific organisational setting. What became apparent was that some CSFs were more frequently mentioned than others. This indicates that either some CSFs are included in other CSFs, or that some factors are not perceived as critical enough to be defined as a CSF. For example, top management commitment was reported in every source identified and therefore it is the most mentioned CSF among the eleven. This fact however was not sufficient to make a statement on the relationship between each CSF. Hence, a reliable way to address the relationship was needed. In addition, the CSFs needed to follow a structure that should not only build on literature or researchers' experience. The outcome of the method was a model representing each CSF and their interrelationship illustrated by arrows. The preceding MICMAC analysis revealed that the eleven CSFs were positioned in three groups. The first group (*create sense of urgency; create clear vision; secure top management commitment*) presented the most influential CSFs; the second group (*provide sufficient resources; provide training/education; introduce an incentive system; enhance understanding of processes; support communication at all levels; define specific goals; create and define performance measurements*) represented an unstable set of CSFs, as many had high influence but were constrained by an equal or higher dependency; and the third group (*follow rules of project management*) presented the least influential CSF.

In the following chapter, the results from this chapter build the core of the SLSS framework. The framework is introduced and approaches to manage the CSFs are presented. The final (validated) SLSS framework is then presented in Chapter 7.

CHAPTER 6:

THE PROPOSED FRAMEWORK ELEMENTS & STRUCTURE

6.1 Introduction

In Chapter 5, a thorough literature analysis was conducted with the aim to identify CSFs for the integration of LSS. In addition, a methodological approach to obtain a structural model was conducted and the results were presented. In this chapter, the findings from Chapter 5 are transformed into a practical framework aiming to support healthcare professional in integrating LSS in their organisation. In addition to the findings from Chapter 5, the insight obtained from the survey presented in Chapter 4 is utilised. The survey highlighted the need for a sustainable framework and reported the mismanagement of CSFs. Either some CSFs were unknown to the sample, or they were not perceived as critical for the integration of LSS. This is where Chapter 6 launches into the importance of CSFs and proposes the SLSS framework.

The chapter begins with the basic structure and principle of the framework. It proceeds to explain the components of the framework. The framework is built on four phases which have to be followed consecutively. Each phase consists of a detailed description of possible approaches to address each component. The approaches are presented in the form of flow charts for each component in order to facilitate the use of the framework for practitioners. This chapter ends with a conclusion and proceeds to the validation chapter, where the final framework is presented.

6.2 Structure of the Framework

The proposed framework is based on the output of extensive literature review, a survey providing insight in the use of LSS in healthcare and the output of several expert interviews.

Considering several frameworks and cases of change management it became clear that the initial stage of any change effort was to assess the nature of change. Furthermore, the literature review in Chapter 2 reported several cases

of LSS in healthcare and highlighted the problems faced by LSS. Therefore, a survey was conducted with the objective to explore how LSS was perceived and used in hospitals. The results of the survey in Chapter 4 showed that hospitals were neglecting several factors that were essential for a successful integration of LSS. On these grounds, Chapter 5 focused on identifying critical success factors for the integration of LSS in healthcare. In addition, experts were asked to provide input regarding the structure of the identified factors.

Figure 6.1 shows that the Sustainable Lean Six Sigma (SLSS) framework is grouped into four phases. Phase A was created based on the fact that every change initiative needs prior analysis regarding the nature of change. Phases B, C and D were grouped based on the results of a questionnaire using the ISM method and a threshold analysis using MICMAC.

The phases of the framework are:

- Phase A: Defines the Nature of Change, including the assessment of forces and resistance to change and the organisations change type.
- Phase B: Focuses on three of the eleven critical success factors. These factors are essential for starting the integration initiative. If this Phase is weak the integration of LSS should not start.
- Phase C: Includes the majority of factors which are unstable and need special attention. If this Phase is weak the integration of LSS is likely to fail.
- Phase D: Represents the last step of the integration process and beginning of the implementation of LSS on a project level. The integration process will not immediately fail if this Phase is neglected. However, by continuously failing to meet project management requirements, projects will start failing and the integration of LSS may not be sustainable.

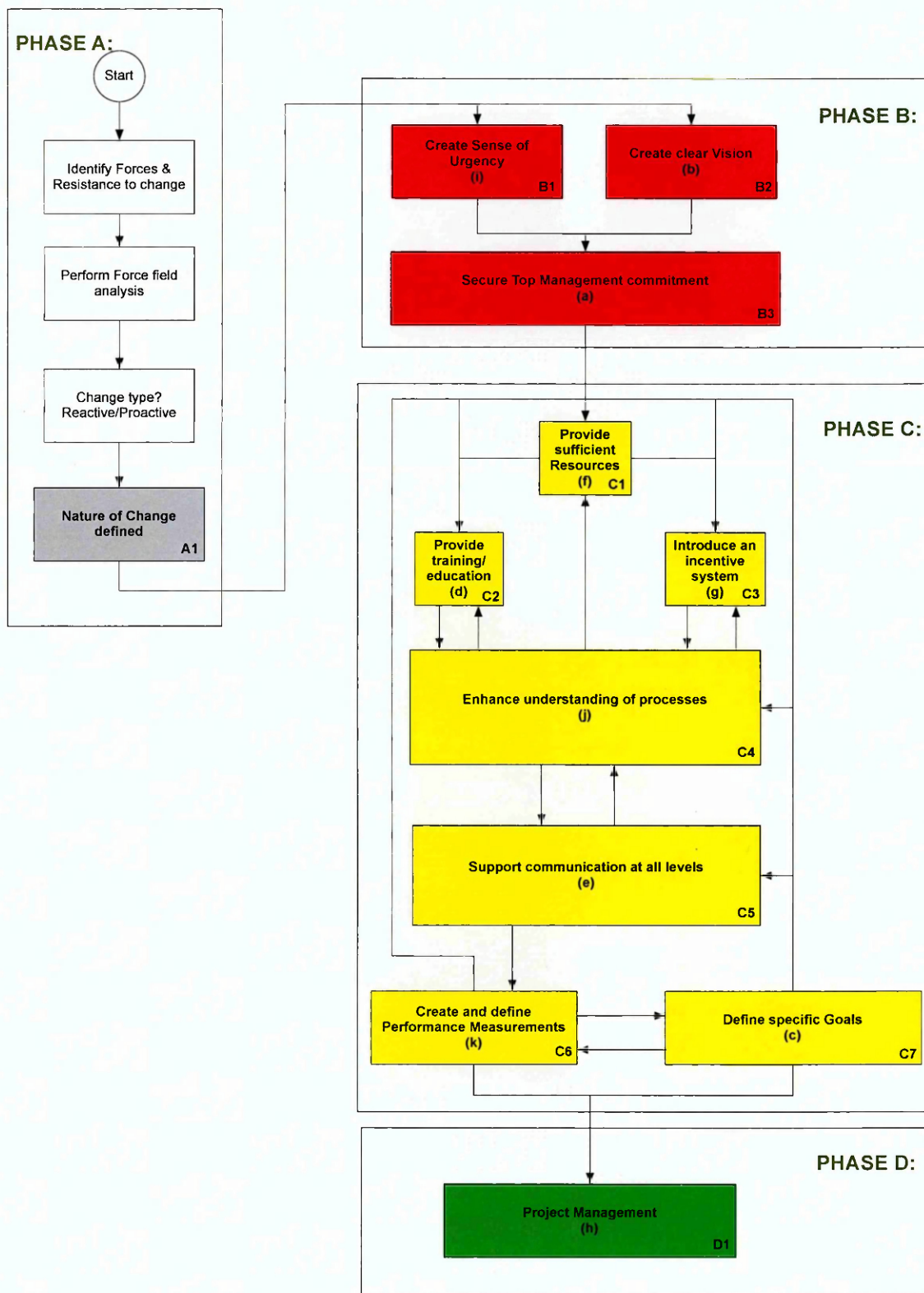


Figure 6.1: The Proposed SLSS Framework

The SLSS framework has to be interpreted as a framework supporting healthcare practitioners to integrate LSS. All factors presented in the framework are crucial for this endeavour. Hence, only by paying continuous attention to

each factor and phase can a sustainable LSS be realised. The structure of the factors also provides practitioners with a roadmap knowing which factors to focus on first, yet keeping in mind that each factor is critical for a successful integration.

6.3 Phase A

Phase A represents the beginning of the framework. The steps included in this phase aim to assess the readiness of the organisation towards integrating Lean Six Sigma. By following the proposed steps the organisation can gain insight into how likely it is that they will be able to integrate LSS based on the level of resistance faced. Furthermore, this phase allows a high level of flexibility, as it does not constrain the organisation by only choosing two paths (change or no change). It applies change path diagnostics, which allows organisations to consider changing despite having high resistance and low forces to change. Additionally, organisations can follow the path of their change and make adjustments when necessary.

6.3.1 Lewin's Resistance Vs Forces to Change

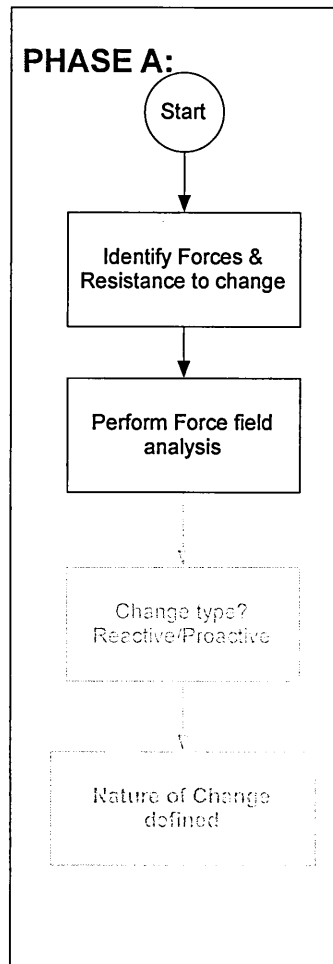


Figure 6.2: SLSS - phase A: Identification and Analysis of Forces

The first two steps in Phase A refer to the identification of resistance and forces to change and Lewin's force field analysis. The identification of resistance and forces to change depends on tools such as brainstorming, group discussion or debates. In order to receive a valid picture of the forces for and against the change of the organisation, the composition of an interdisciplinary team of employees is needed. Lewin not only proposed to list the forces but also added a quantitative aspect to the analysis by demanding to quantify the impact of each force. For that reason, brainstorming in a group and discussing the forces seems to be the most efficient approach.

Based on an example, Figure 6.3 illustrates how Lewin's force field analysis is applied. During the brainstorm session forces are identified and classified as

either forces which drive the initiative (driving forces) or forces which inhibit the initiative (resisting forces). The driving forces are allocated on the left and resisting forces are allocated on the right side of the box which represents the issue discussed. In this case the issue is the integration of Lean Six Sigma in a hospital. The numbers next to each force represent the impact level on the issue. For this example the measurement scale was chosen to range from 1 to 5, with 5 being the highest impact. The force field analysis concludes with the summation of the forces' impact levels. The outcome of the analysis illustrates the actual situation the hospitals face when wanting to pursue the initiative. It encourages the employees to work on reducing the resisting forces in order to make the initiative more likely succeed.

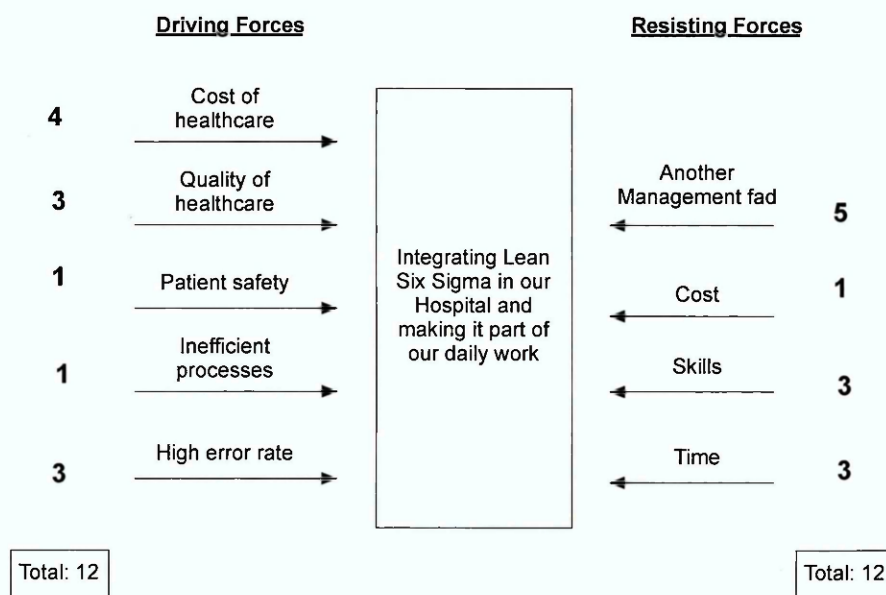


Figure 6.3: Lewin's Force Field Analysis

A structured way to reduce resisting forces is to make a list of possible actions to reduce the forces by brainstorming sessions and then prioritising which action on a force delivers the best result.

6.3.2 Strebel's Change Path

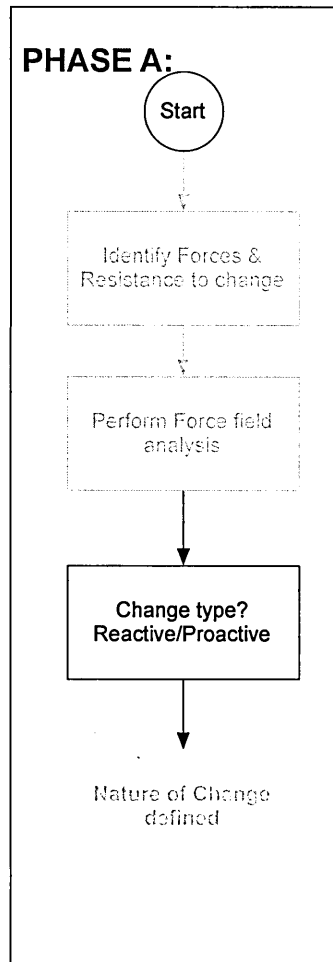


Figure 6.4: SLSS - phase A: Change Path - Reactive or Proactive?

The next step in phase A is the analysis of the hospital's change type in connection with the hospital's change path. Based on the information - obtained from the prior steps - on the driving and resisting forces, the change type of the hospital can be assessed. Strebel discovered that organisations follow specific change paths. In total he observed eight change paths. Once an organisation embarks on a change journey it will follow a change path. However, the organisation does not necessarily stay on one path; as time passes it may follow different change paths. He provided a tool to diagnose which change path the organisation is on. With this information the organisation is able to adjust their route and change to a more efficient path, which will lead them to successful change. Figure 6.5 shows the change path diagnostics extended by further information regarding the characteristics of the path, short

recommendations regarding what to do when wanting to follow the particular change path and the categorisation of each change path according to scope, depth and urgency derived from the research of Thompson (2010).

	Are The Change Forces strong?	Can Resistance be overcome?	Do the Change forces represent Opportunities?	How much Time do you have available?	Can Change Forces be easily identified?	Is your Organisation open/closed to change?
Resistance	Yes	No	No			
Renewal	Yes	No	Yes			
Revitalisation	Yes	Yes		Significant		
Restructuring	Yes	Yes		Little		
Cascading Implementation	No				Yes	Open
Realignment	No				Yes	Closed
Bottom Up Experiment	No				No	Open
Reengineering	No				No	Closed

Characteristics of the Path?	Scope	Depth	Urgency	What to do?
Little change that takes places is used to reduce pressure occurring from strong Change forces				As internal change is not possible, change needs to start with help from outside
The pace of change is sporadic and may involve both internal and external Organisation with various Stakeholders	Narrow	Specific	Unplanned	As the change forces do not represent a threat to the Organisation, use stepwise change
Slow but continuous change. A cultural Revolution describes this path best.	Broad	Transformational	Planned/ Unplanned	Overcome Resistance. Change Status quo employees into Change Agents
As time available to change is limited the Organisation is given a sharp shock to adapt to its environment	Broad/ Narrow	Specific/ Transformational	Unplanned	Sudden intense change is necessary, imposed from the Top Down (e.g. radical cost reduction)
Is open to change and can start implementing change.	Broad	Transformational	Planned	Encourage Managers to become Change agents and start Stepwise change combined with a Top Down implementation
High resistance but easy identified change forces.	Broad	Transformational	Planned	Bring Organisation to recognise Change forces by challenging it with another Org. that is closer to change forces. Signal Emergency!
Open to Change and needs successful change Initiatives in order to proceed in changing.	Broad/ Narrow	Specific	Planned	Identify Change Forces by encouraging experimentation in order to find a successful change. It can then be used to drive change from bottom up
Organisation is closed to change and has difficulties in identifying the change forces	Broad/ Narrow	Specific	Planned	Create sense of discomfort with things as they are. Use Benchmarking with other Organisations in order to identify change forces.

Figure 6.5: Revised Change Path Diagnostic

After identifying and assessing the forces and resistance to change, the hospital will have to ask several questions in order to identify the change path they will embark upon. If the forces to change are strong the hospital's change type can be described as reactive (the first four rows in Figure 6.5), and if they are weak the hospital's change type is proactive. A reactive change type is characterised by high pressure to change. Hospitals that have pressure, either externally or internally, from different stakeholders, will want to react to the pressure by

seeking change. On the other hand, a proactive hospital will want to change despite the existing scenario being good. This change type is considered by far the most difficult change to realise, but also the most sustainable approach. Hospitals that choose to change because they want to improve and become competitive, and who are not forced, are more likely to sustain the changes, as they made their choice out of free will.

Each change type has four change paths with a total of eight paths. Figure 6.5 can be used to help hospitals to identify their change path according to several questions. For example, a hospital with a reactive change type (strong forces to change) will try to determine if resistance to change can be overcome. The reason lies in the fact that despite forces to change being strong, resisting forces could be equally strong (as shown in Figure 6.3), and therefore organisations should determine if the obstacle of high resistance could be overcome. If the answer is “yes” then the next question will be related to the timeframe available for the change initiative. An organisation with significant time available will follow a revitalisation change path; on the other hand, if little time is available the organisation will follow a restructuring change path. Revitalisation is characterised by a slow but continuous change approach, which can be obtained by steadily overcoming resistance and changing employees with a complacent attitude into change agents. To provide further insight, the researcher adopted Thompson's (2010) research by categorising each path according to the scope, depth and urgency of the change. Hence, an organisation following a revitalisation change path will have a broad scope of change, as the change is on-going and permeates the whole organisation, and is not confined to specific areas. The depth of change is transformational, as it is organisation-wide and produces simultaneous changes in structure, strategy and culture. Finally, the urgency of change is both planned and unplanned. It is planned as there is enough time available to complete the change initiative despite being pressured from stakeholders. On the other side, it is unplanned as the change is unexpected and requires demanding immediate action due to circumstances beyond the organisation's control.

The provided guideline (Figure 6.5) allows the hospital to follow a change path according to their needs and situation. In addition, the frequent diagnosis (e.g.

yearly) of the hospital's change path will keep the change on track and warn the hospital when they are moving to another change path. In the course of time the hospital will most likely shift to other change paths, which can have a positive or negative impact on the initiative. Therefore it is imperative that top management knows how to steer the change and in which pace.

6.3.3 Define Nature of Change

The forces and type of change define the nature of change. Phase A defines the nature of change by identifying and analysing the driving and resisting forces of change. In addition, it provides a way to determine the hospital's change type and the path it will take to achieve the change.

After the hospital has determined its individual nature of change, the focus lies in working on the factors that are critical for the successful integration of LSS. In the following, phases B, C and D will address this issue.

6.4 Phase B

This particular phase focuses on CSFs which had the highest impact on the integration of LSS. Chapter 5 showed that sense of urgency and vision were the dominant factors, having the highest impact on the other CSFs. Top management commitment was determined to be second highest. The MICMAC analysis illustrated that these three factors create a group of high-impact CSFs, and they therefore constitute phase B.

6.4.1 Create Sense of Urgency

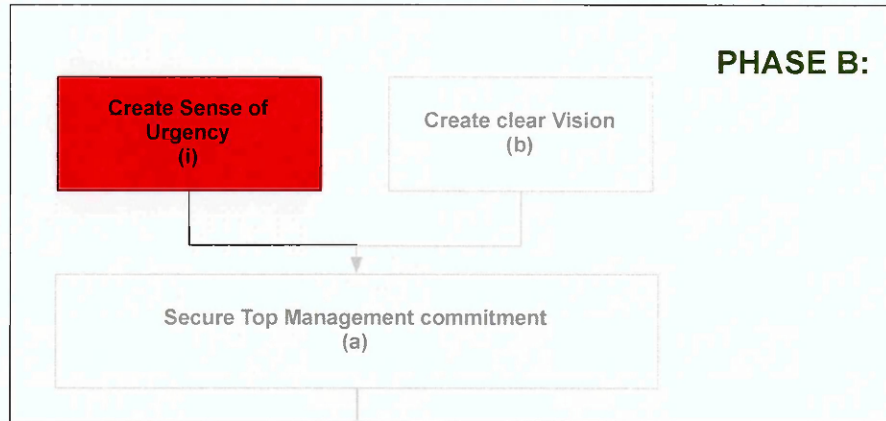


Figure 6.6: SLSS - Phase B: Creating Sense of Urgency

Despite sense of urgency frequently being mentioned as imperative for a successful change, it has rarely been classified as a critical success factor of LSS. The results from the survey (Chapter 4) however show that it is perceived as important to communicate the need for LSS, with all participants reporting a high to moderate communication of sense of urgency.

There are several ways of creating sense of urgency, one of which is illustrated in Figure 6.7. It follows the research and advice provided by several change management experts with focus on the work of Kotter (2008).

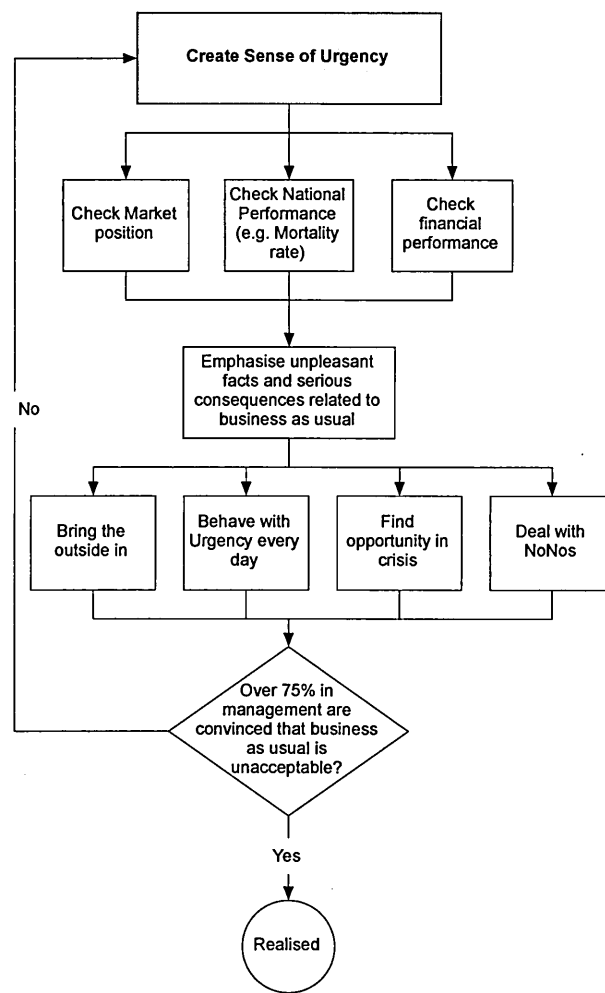


Figure 6.7: A Way of Creating Sense of Urgency

A good communication of the sense of urgency depends on the information obtained regarding the market position, national performance and financial performance of a hospital. The information is critical to the existence of the hospital and puts more weight on the argument that the hospital needs to change. The more negative the information the easier it will be to communicate a sense of urgency. A hospital which ranks nationally lowest on the mortality rate will sooner or later disappear if no change takes place. The mortality rate adjusted by the adverse event ratio (ratio referring to events which went wrong and could have been prevented resulting in death) is a good indicator for hospitals to communicate the need to increase the quality of healthcare by integrating LSS.

After obtaining enough information to back up the argument and emphasising unpleasant facts and serious consequences related to business as usual, several actions need to be taken to translate theory into practice. Kotter (2008)

suggested four actions to be taken: bringing the outside in, behaving with urgency every day, finding opportunities in crisis and dealing with NoNos.

Bringing the outside in will support the prior steps of information-gathering for building the case that change is needed. This step will bring new ideas and different points of view into the hospital. So far the NHS has followed this step by allowing their staff to gain insight from different hospitals and industry sectors. This includes visits to manufacturers such as Toyota to learn about the application of Lean principles. Staff members are able to see that the theory can be applied in real-life cases and not only in a manufacturing environment, as Royal Bolton Hospital proves. In addition, this step emphasises the need to publicly communicate the situation in the hospital. The communication should focus on what is going wrong and not only include the good aspects. Furthermore, national performance reviews provide a good source of information that can be used to create a sense of urgency. A practical example is the bad mortality rate review of Royal Bolton Hospital (RBH) in 2008/09. The mortality rate was 21.98% over the national average, indicating that the RBH was among the worst hospitals in the UK (Dr Foster 2008). The publicity and resulting pressure from stakeholders created a sense of urgency to change the status quo. Hence RBH is aiming to be in the top 10% in UK for hospital mortality rates in the next five years (RBH 2011).

The next action refers to "walking the talk". The sense of urgency, which is expected to be lived by the staff, has to be lived by top management as role models. Creating a sense of urgency is not a project but a way of being, therefore Kotter (2008) argued that behaving with urgency everyday is a way to sustain urgency. This action overlaps with skills that are required from good leaders. Behaving with urgency every day could include managers conveying excitement, appreciating contribution and expecting high standards, all of which are attributes connected with good leadership.

Crises often occur, and Kotter (2008) recommends adopting a positive attitude towards problems. He argues that crises can be the beginning of change by carefully planning a response rather than impulsively reacting to a crisis. When crises occur possibilities present themselves to change the status quo. A crisis

can, for example, expedite the unfreezing step of Lewin's change model. Finding opportunities in a crisis is comparable to the principles of Lean advertising for a blame-free culture: "when mistakes are done the focus is not on finding the guilty one but finding the cause which led to the mistake". Hence, when crisis occur, fear and panic should be held under control and the focus should be on creating opportunities.

The final action refers to employees advocating the status quo and obstructing efforts to move on. These particular employees cannot be convinced and will try to undermine any attempts to create a sense of urgency, as they see no reason to change. Kotter (2008) sees a difference between this type of people and general sceptics. Sceptics bring an important balance to discussions; however, the other group is closed to information, not even considering valid evidence (data). So far, Kotter (2008) reported three strategies for delivering successful results. One strategy is to distract this group by sending them on a special assignment as far away from the change initiative as possible. Another strategy is getting them out of the organisation. The third strategy is putting social pressure on the group by calling out their behaviour in public. Less confrontational strategies are more common (due to their more amenable interpersonal format), such as co-optation or excluding the group from work by leaving them out of meetings, but these have not proven successful.

The creation of urgency is concluded by evaluating how many in management are convinced that business as usual is unacceptable. Kotter (1995) argued that over three-quarters of management have to be convinced that business as usual is unacceptable for a sense of urgency to be strong enough to drive the change. If that percentage is not realised it is advised to work through the prior steps to gradually reach that percentage.

6.4.2 Create Clear Vision

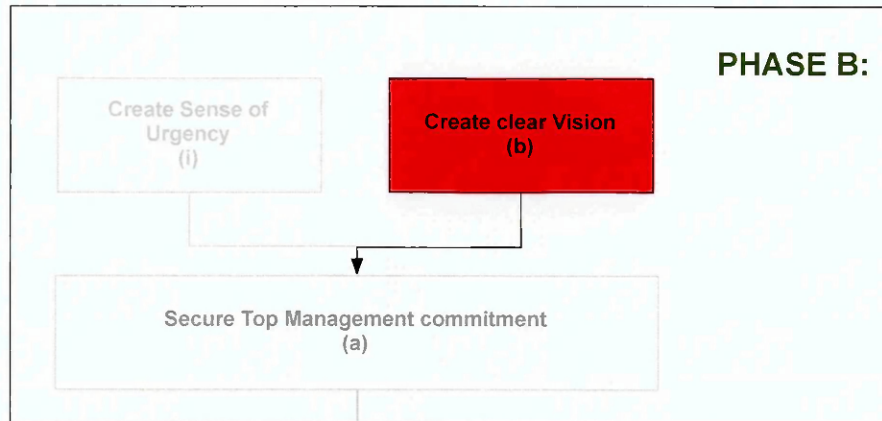


Figure 6.8: SLSS - Phase B: Create Clear Vision

The results in Chapter 5 illustrate how important the creation of an appealing vision is for the change of an organisation. “Create clear vision” and “create sense of urgency” are equally influential. Every subsequent factor is influenced by the creation of a vision, and therefore depends on a good vision.

Figure 6.9 illustrates how clear vision can be created and is founded on research and practical implementation from Maurer (2000), Blanchard (2010) and Kotter (1996).

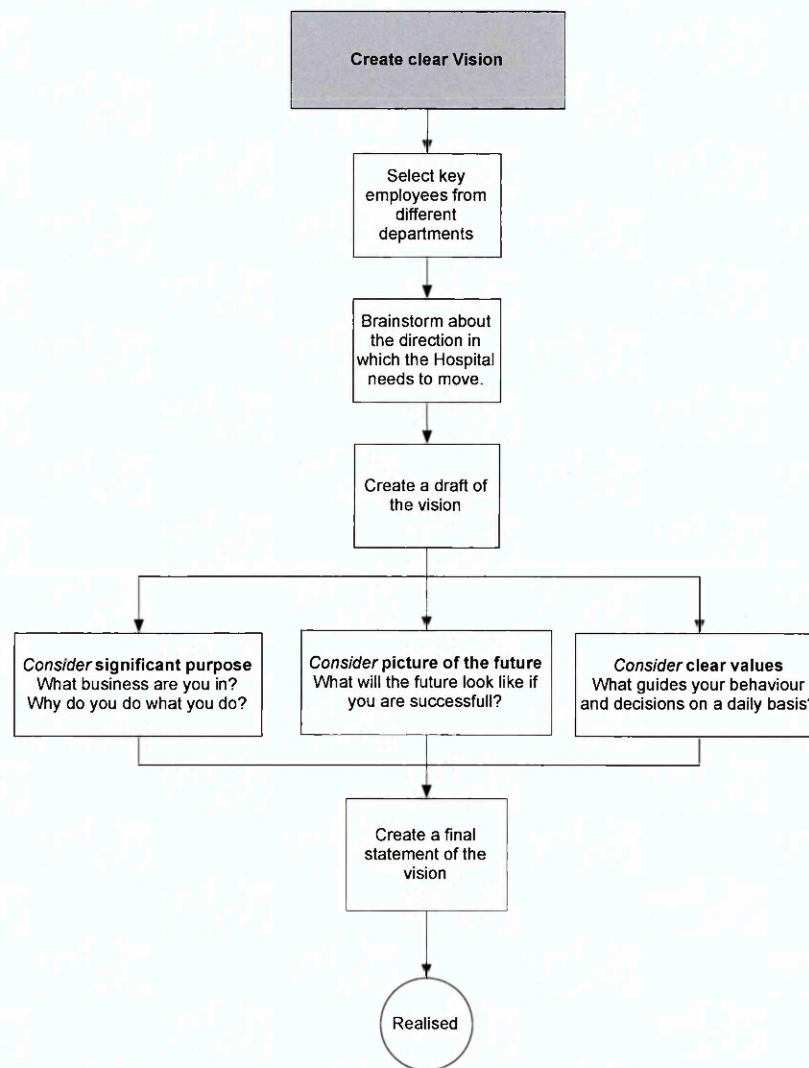


Figure 6.9: A Way of Creating a Clear Vision

Main contributors to the theory of vision such as Peter Senge and Peter Block believe that the process of creating a vision should be individual-driven. Individuals in the organisation should share their thoughts and drive the creation of a vision. On the other hand, some researchers (such as Alan Wilkins) believe that the creation of vision should be leader-driven. The leader has a specific idea and requests input from other individuals (Harris 1995). What both parties have in common is the need for information-sharing in the form of discussions and brainstorming. Hence, the process of creating a clear vision begins with the selection of individuals with different points of view and brainstorming sessions about the future state of the hospital.

During the brainstorm session the individuals should discuss the reason the hospital exists, whom it serves, what the customer should receive and what the

ultimate result is that they seek. Having answered the questions, all individuals should imagine where they would like to see their hospital in three to five years from that time. Following the discussions, a draft of the vision including all inputs is created. Creating the draft of the vision is similar to conducting pilot surveys before the big survey. The draft acts as a testing platform wherein ideas are carried together and a possible future state is developed. According to Kotter (1995), many organisations tend to culminate the process at this step. However, the vision statement at this stage has many flaws as it is blurry and unclear. He therefore recommended holding multiple brainstorming sessions over a three-, five- or even twelve-month period of time. This will guarantee a more deeply considered vision statement representing the desires of employees.

While working on the final vision statement several factors have to be taken into account. Blanchard (2010) summarised and categorised the input of several experts and presented three main factors which should be considered in the process of creating a vision. Significant purpose describes why - for what purpose - the organisation exists, and should be addressed in order to inspire excitement and commitment. Beside a significant purpose, a vision should draw a picture of the future reflecting on how the future would look if the organisation is successful. This picture should be kept simple and not abstract. In fact, Blanchard states that numerous studies have demonstrated that the power of imagery has a positive influence on the performance and intrinsic motivation. Lastly, a vision has to represent the values of the employees and the organisation. It provides guidelines for choices and actions and defines what is right and important to everyone in the organisation. For example, considering Royal Bolton Hospital's (RBH) vision statement:

By 2016 we will match the best integrated care organisations internationally for the quality and efficiency of our services. We want to be known for the safety, effectiveness and compassion of the care we provide. (RBH 2011, p.5)

This statement can be broken down into the above-mentioned factors. The *significant purpose* of RBH is to deliver care as an integrated care organisation. Individuals at RBH *picture* the Hospital to be among the best-integrated care organisations internationally in terms of the quality and efficiency of their

services by 2016. Finally, RBH wants everyone one to know that they highly *value* safety, effective care and have compassion for what they do.

6.4.3 Secure Top Management Commitment



Figure 6.10: SLSS - Phase B: Secure Top Management Commitment

Top management commitment is the factor with the second highest impact ratio and only depends on the influence of “create sense of urgency” and “create clear vision”. This factor was considered as one of the greatest concerns when integrating LSS (see Chapter 4). Unsurprisingly, “top management commitment” has been frequently reported in the literature as a critical success factor.

In the following, a way of securing “top management commitment” is proposed. Rather than a step-by-step guide it provides insight on what to pay attention to, based on multiple discussions at conferences and seminars between the researcher and LSS experts.

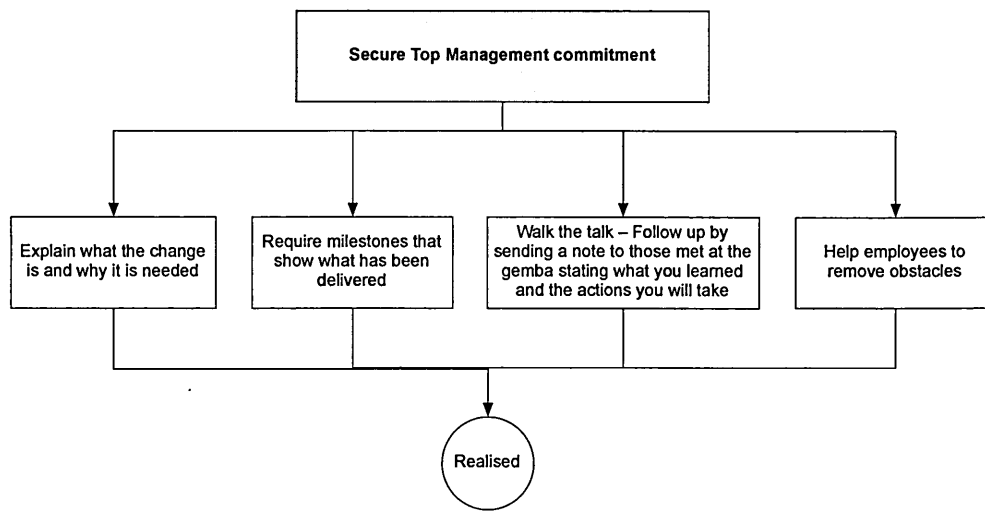


Figure 6.11: A Way of Securing Top Management Commitment

There are several points which are worth paying attention to when securing top management commitment. Most of these points overlap with the process steps of other CSFs. For instance, explaining what the change is and why it is needed overlaps with the process steps from “create sense of urgency”. Information about the market position, and national and financial performance supports the explanation of why change is needed. In addition, steps in “create clear vision” provide the answer to what the change is. Experts highlighted that this point is crucial and should occur in a repetitive way, meaning that it gets repeated on a monthly or weekly basis (e.g. in meetings) in order to remove room for uncertainty among staff.

The next most frequently mentioned point is accountability in form of monitoring the progress and outcome of services delivered. A close monitoring process is crucial; hence top management ought to require milestones that show what has been delivered. Top management should monitor how each deliverable brings them closer to the goal.

Next is “walk the talk”, which refers to the state wherein top management partakes in change and plays an active role. Cases report management focusing mainly on delegating and planning, and not knowing what is happening in the process. It is therefore important to go and see how the change is delivered and how staff are affected by the changes. This point concludes by following up with a note to each person met at the gemba, stating what they

learned and the actions they will take. This has several advantages; it signals a proactive attitude showing staff that top management cares and is committed. It also reduces wrong decisions by top management due to inferior knowledge regarding the processes of the organisation.

Finally, during change initiatives several obstacles can occur and hinder progress, hence top management ought to help staff to overcome obstacles.

In general, showing commitment does not follow a set of rules or a sequence of steps. An executive (MBB) with over 20 years of experience in the service sector described top management commitment as quoted: "Showing commitment is showing that change matters to you". By following the above mentioned points top management comes closer to signalling their commitment.

6.5 Phase C

Phase C represents the CSFs that can cause the integration initiative to collapse due to their unstable nature. These factors are termed unstable, as they do not have a clear impact ratio, meaning that they neither have a clear negative or positive ratio. They influence other factors and get influenced by the same factors (interrelationship), hence they have to be dealt with caution.

As this phase represents the majority of CSFs, taking action might seem difficult, as the user does not know which CSF to approach first. As a consequence, the ISM methodology proposes a structure where the CSFs are prioritised allowing the user to focus. Nevertheless, it is important to note that the prioritisation may vary strongly depending on the relative importance the organisation bestows on some CSFs.

6.5.1 Provide Sufficient Resources

The results presented in Chapter 5 show that "resources" has the only positive ratio between driving and dependence forces, out of all CSFs in Phase C. That

implies that "resources" drives more CSFs and depends on less CSFs. Hence, "resources" is positioned above all other CSFs in Phase C.

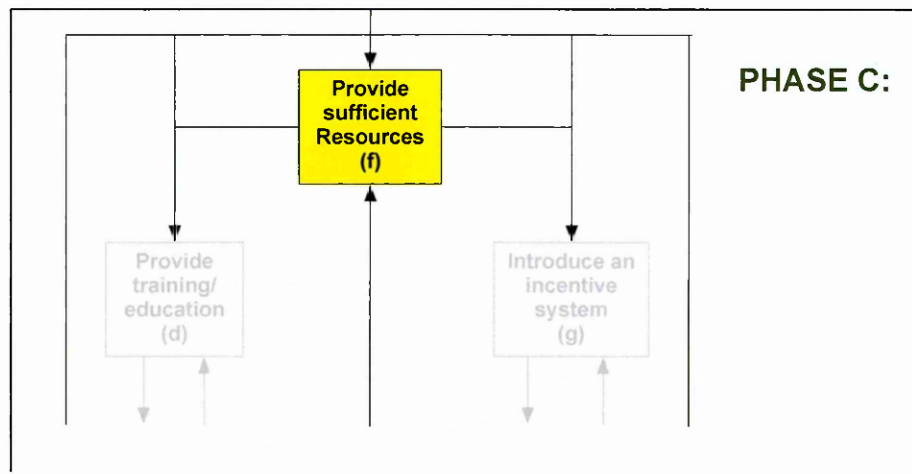


Figure 6.12: SLSS - Phase C: Provide Sufficient Resources

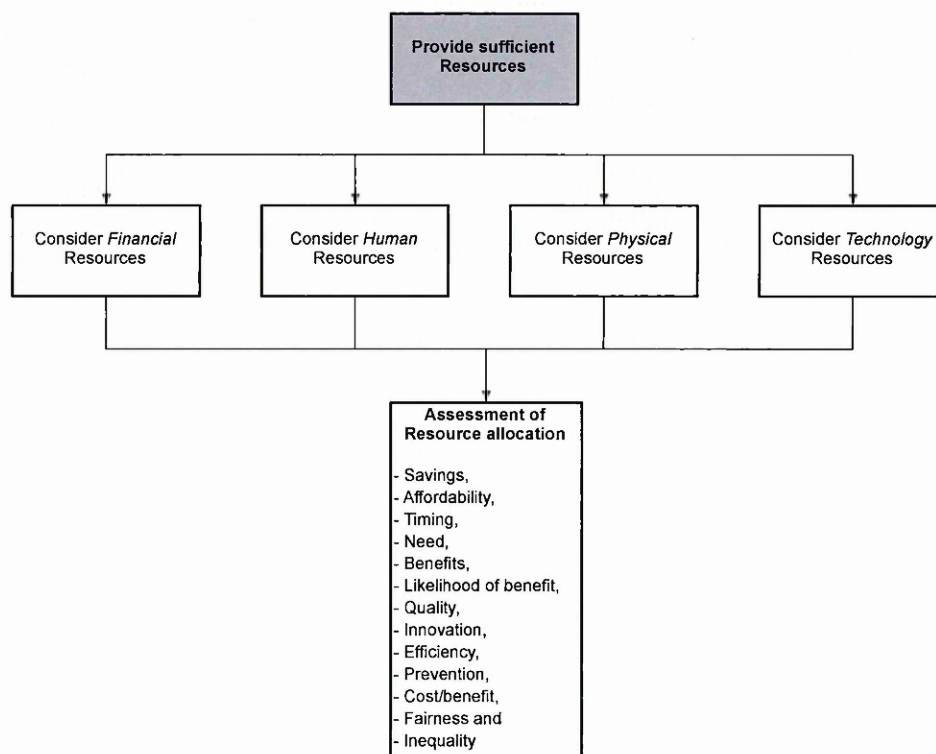


Figure 6.13: What to Consider When Providing Sufficient Resources

How to allocate resources is based on the preferences a hospital has and what resources other stakeholders have provided. Stakeholders in particular need to be pleased, which is a challenge as the expectations and objectives of each stakeholder differ. Hence, it is important for the hospitals to focus on what

resources they have and assess the allocation keeping the stakeholder issue in mind.

Figure 6.13 illustrates what to consider when providing sufficient resources and is made of two steps. First, the resources that every hospital has to manage are introduced, and second, a list of dimensions is provided to assess the allocation of resources.

Financial resources are what top management and the hospital use in order to reach the organisational goal. They can include loans, creditors, cash balances or the ability to raise new funds. Finance managers should be aware of the processes at the gemba and support staff to identify the cost of the activities within the process. Considering several indicators such as cycle time, staff costs and cost of materials provide finance managers with the necessary data to manage and allocate financial resources.

Human resources include the identification of staffing requirements, skill development, planning and control of payroll and benefits etc. It is essential for allocating the right people with the right skills to the right projects.

Physical resources cover the operational assets of a hospital with the goal to provide it with the physical capability to fulfil their goals. They include materials, facilities, equipment and vehicles.

Technology resources provide the data in the organisation, which is particularly essential for the use of Six Sigma. It includes ERP systems, databases and the whole technological infrastructure of the hospital.

After considering the four resources it should be clear what the hospital can and cannot do for the integration of LSS. Eventually the hospital will face the need to allocate the resources and should base their decision on a set of dimensions. The allocation of resources needs to be assessed on:

- savings - real financial savings without reducing service quality.
- affordability - of course the particular resource need to be available.

- timing - the resource allocation is urgent in order not to lose benefits.
- need - is the resource allocation really needed from a stakeholder and organisational point of view?
- benefits - will it benefit the stakeholders and organisation?
- likelihood of benefits - how likely is it that it will benefit? Prove by cases and theory that it will deliver the benefit.
- quality - addressing the clinical effectiveness.
- innovation - considered when relevant. Are resources available used in a more efficient way?
- efficiency - how are resources used currently?
- prevention - can the allocation prevent or reduce the likelihood of future adverse events?
- cost/benefit - provide a breakdown of all costs and compare to benefit.
- fairness - the allocation of resources should be based on a just decision considering all mentioned dimensions.
- inequality - does the allocation help to reduce health inequality?

The provided information of resources and dimensions for the allocation of resources are meant to support top management to make the right decision when allocating resources.

6.5.2 Provide Training/Education

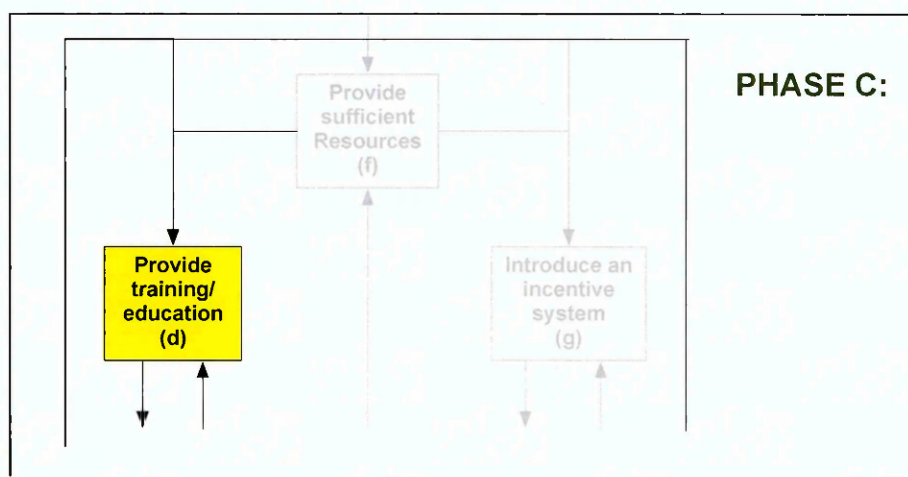


Figure 6.14: SLSS - Phase C: Provide Training/Education

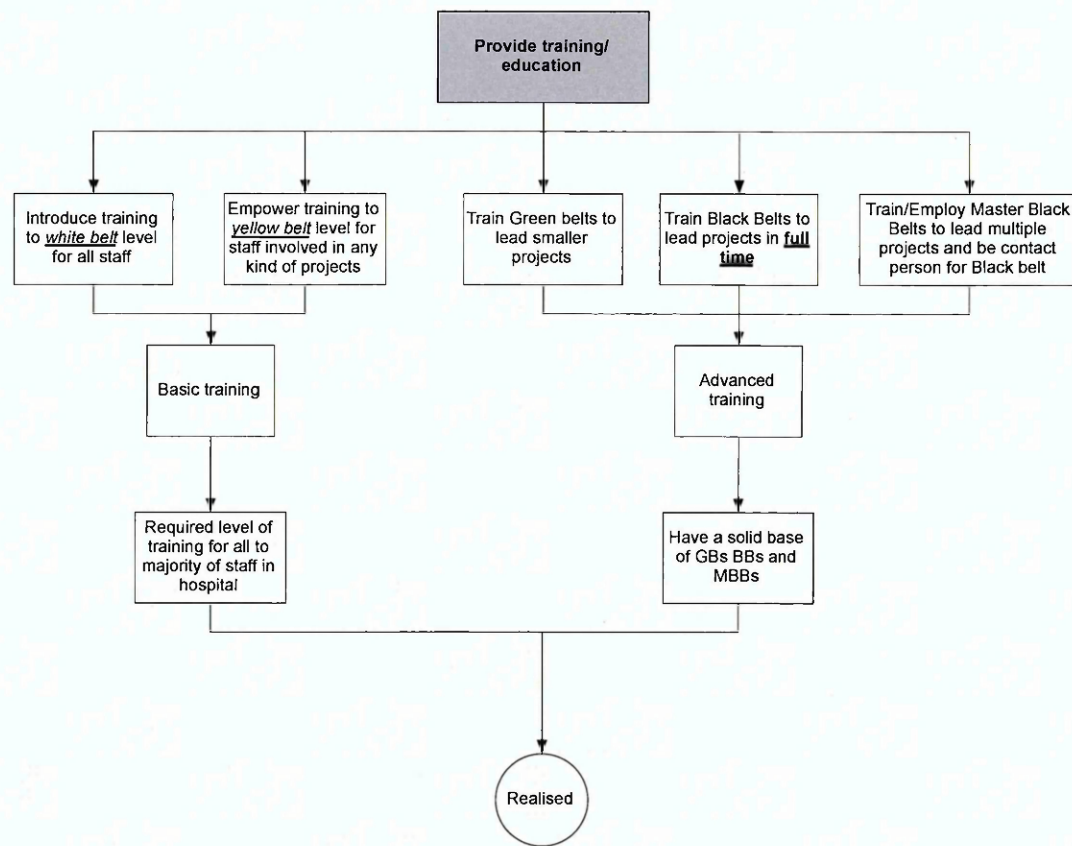


Figure 6.15: Providing Training/Education

Providing training to handle LSS tools and educating staff to understand the interaction of management philosophies with their organisation and the underlying factors that are critical to a successful integration has been mentioned as frequently as "top management commitment" throughout the literature. Among practitioners and researchers a clear consensus exists on how to deliver training and educate staff. Six Sigma offers a range of training from absolute beginner (White Belt), beginner (Yellow Belt), average user (Green Belt) and advanced user (Black Belt). A person with the highest level of knowledge in Six Sigma is certified as a Master Black Belt and is responsible to lead multiple projects and to support Black Belts. Training in Six Sigma is not standardised, hence basically everyone can offer certification in Six Sigma, making it difficult to judge the quality for organisations. Nevertheless, over the years the six sigma community has come up with a set of requirements each certification level should have. In addition, Lean has been included in many training curricula.

Figure 6.15 illustrates how organisations should make use of the different certification levels in order to realise a sustainable LSS. Based on the results of cases in hospitals, a distinction is made between what everyone in hospitals have to know (basic training) and what staff in specific positions have to know (advanced training).

Basic training differs between the certification Yellow Belt and White Belt. In fact, the latter has been mentioned rarely in cases, as it was introduced as the newest Six Sigma certification, and few companies have as yet integrated it in their training curriculum. The White Belt certification in LSS represents the basic level of knowledge and is delivered in a single day. It introduces the idea and principles of LSS and provides basic awareness of the methodology (either DMAIC or PDCA). This form of certification can be taught to every member of the staff (excluding ones with higher certification) and does not require any previous higher education. Furthermore, certifying every member of the staff as a White Belt has the side benefit of organisation-wide engagement. Yellow Belt as opposed to White Belt offers a more detailed form of training. In addition to what is taught in the White Belt certification, Yellow Belt certified staff members are able to use the most basic LSS tools and function as support in projects. Hence, every member of staff involved in processes which directly influence customers have to be trained at least as Yellow Belts. This form of certified training usually takes less than a week.

On the other hand, staff involved in advanced training require some previous education in statistics and when certified will take over important roles in improvement projects. The lowest certification in this category is Green Belt (GB) and is usually taught over a period of two to four weeks. The DMAIC (or PDCA) methodology is taught in detail referring to each steps challenges and possible solution with core LSS tools. A GB is able to lead small improvement projects and is the most widely distributed certification for LSS. There is a big gap between the knowledge of a GB and Black Belt (BB), however many managers chose to be certified as a GB as it gives good understanding of LSS without demanding full-time commitment towards seeking and implementing improvements. All presented certifications allow the holder to work and

simultaneously be part of improvement projects (excluding cases where GBs take the lead in projects). The exception are the certified BB and Master Black Belt (MBB). A common requirement for a BB is to save the organisation a six-figure sum (GBP). Therefore, according to Meisel et al. (2007) many organisations shift their certified BB staff to full time and redeploy after some years. During this time the BBs lead cross-functional teams and apply DMAIC to solve high-priority cases. Practitioners advise to have BBs deliver around eight projects in two years and redeploy the BBs into the business, as they will have gained leadership and technical skills. The requirements for an MBB are similar to those for a BB, but on a bigger scale. MBBs have profound knowledge of each tool and can help BBs when problems occur. They lead multiple big projects and function as the contact person for BBs. The utilisation of MBBs is questioned in several cases. It is argued that the skill set of MBBs is not required in SMEs, and that they represent a costly alternative to BBs. Hence, hospitals with less than 250 employees do not need to train or employ MBBs as the complexity of problems in such organisations can be tackled by BBs and GBs.

Finally, it is crucial to have a solid base of GBs, BBs and MBBs. According to findings in cases throughout literature, the smaller the organisation the more lower-level certified (WB, YB or GB) staff exist. In order to sustain the benefits of LSS in an organisation, more basic training should take place to convince staff that working according to LSS principles is the right thing to do. Figure 6.15 has illustrated what is important in order to provide training and take steps towards integrating LSS.

6.5.3 Introduce an Incentive System

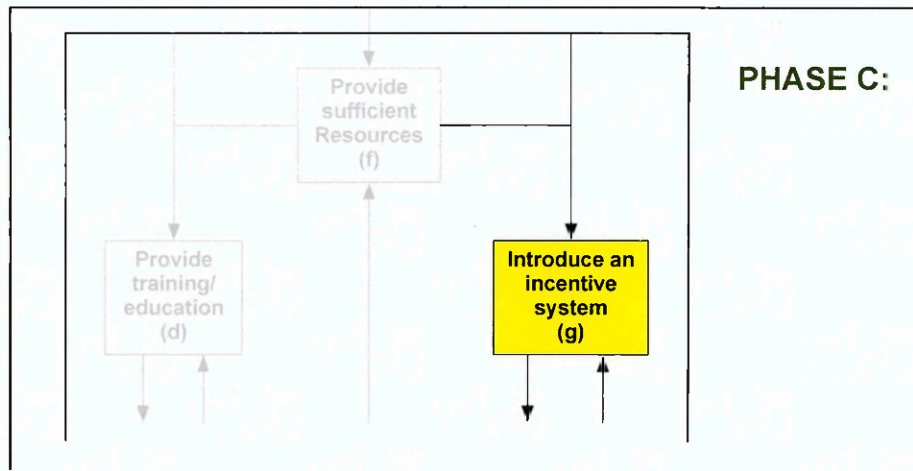


Figure 6.16: SLSS - Phase C: Introduce an Incentive System

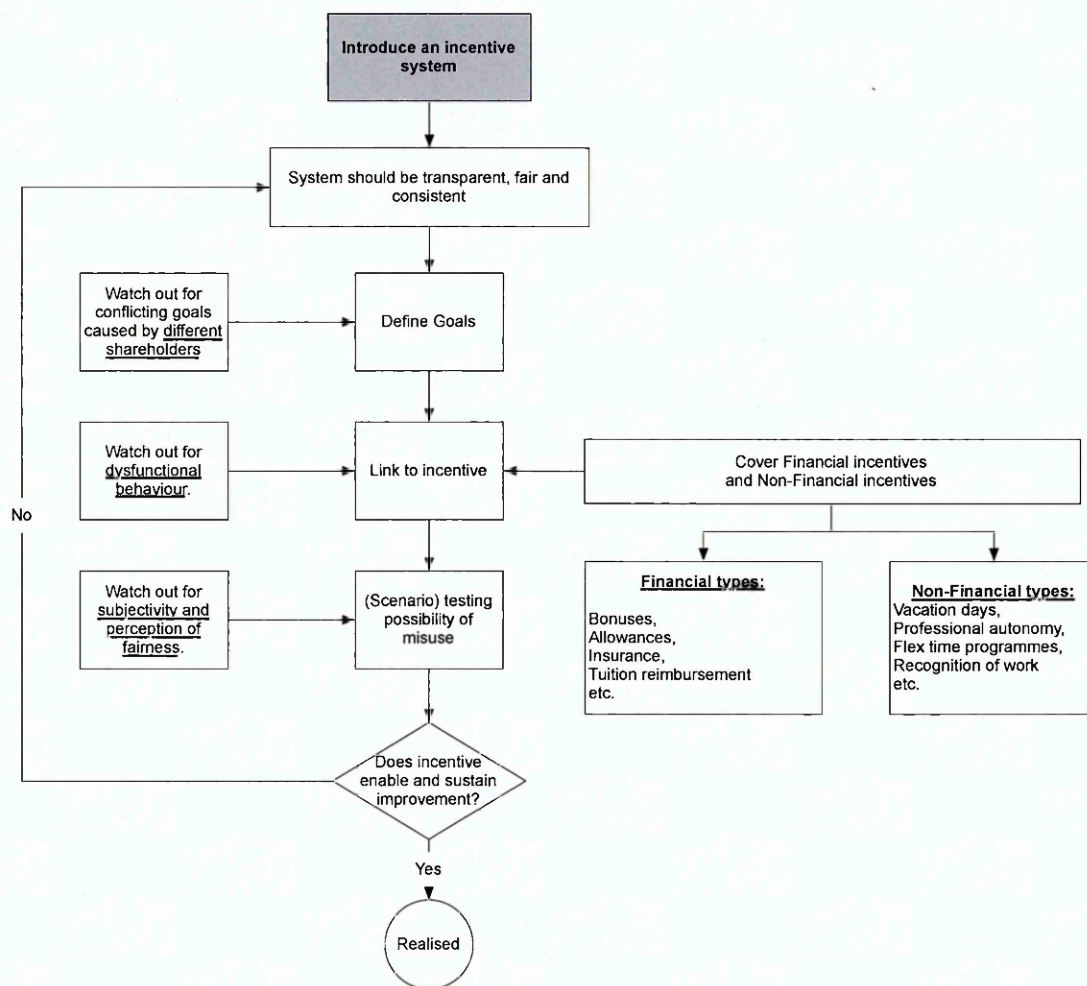


Figure 6.17: Components of an Incentive System

The introduction of an incentive system has been chosen to be as influential as providing training to sustaining LSS in hospitals. It is a crucial step in integrating LSS in hospitals as it motivates staff to continuously work towards improving. However, incentives should be well thought through, as they have the effect of focusing staff on what is rewarded. Hence, there is danger in creating incentives which are counterproductive and do not support the underlying goal. Therefore, in order to obtain a fair, consistent and transparent incentive system, several factors have to be considered, as presented in Figure 6.17.

Incentives need to be measurable, hence they must be linked to goals. Those goals on the other hand have to fulfil specific requirements (refer to Section 6.5.7 in this Chapter). In addition, different shareholders may cause conflicting goals that have to be prevented. A way of preventing conflicting goals is by prioritising the demands of stakeholders. Furthermore, incentives should not create or enhance dysfunctional behaviour. This occurs when goals are not correctly linked to incentives, and financial and non-financial incentives are not equally considered. Examples of dysfunctional behaviour occur when staff neglects unrewarded tasks and only focuses on tasks linked to incentives. It is therefore essential to carry out regular and systematic reviews to evaluate the impact of the incentive. In addition, a well-balanced incentive system including financial and non-financial incentives has proven to produce high results (Metawie and Gilman 2005). Especially in healthcare, non-financial incentives represent a good solution to motivate staff, as financial incentives are not particularly welcomed, as already discussed in Chapter 5.

After the incentive has been linked to goals, scenario-testing takes place. This is done to reduce the possibility of misuse. The incentive system is checked on the danger of conflicting goals and the existence of dysfunctional behaviour. In addition, it needs to consider the influence of subjectivity and perception of fairness. It occurs when quantitative performance measures are weighted against qualitative indicators. For example, performance-related pay in the NHS produces scepticism as soon as qualitative data is included in the performance measurement. It is perceived as unfair and leads to staff questioning the sense

of and need for incentives (Metawie and Gilman 2005). The final step of testing the incentive for possible dangers is important to judge whether the incentive enables and sustains improvement. Finally, the incentive should be added to the incentive system under the condition that both requirements are met. In case the incentive does not enable and sustain improvement, the testing phase continues.

6.5.4 Enhance Understanding of Processes

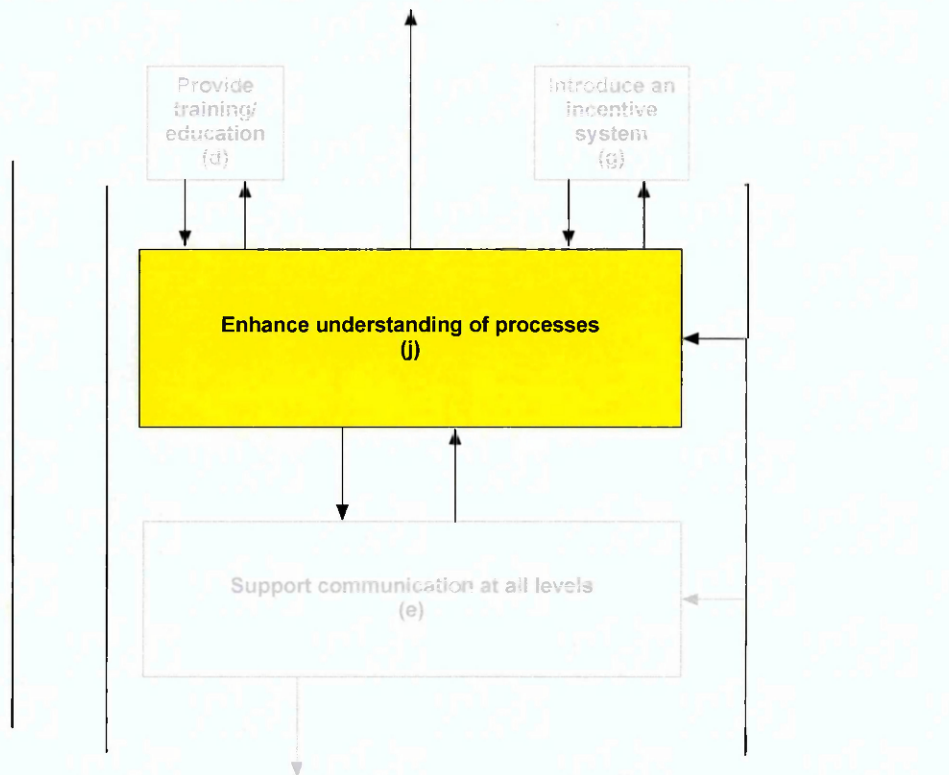


Figure 6.18: SLSS - Phase C: Enhance Understanding of Processes

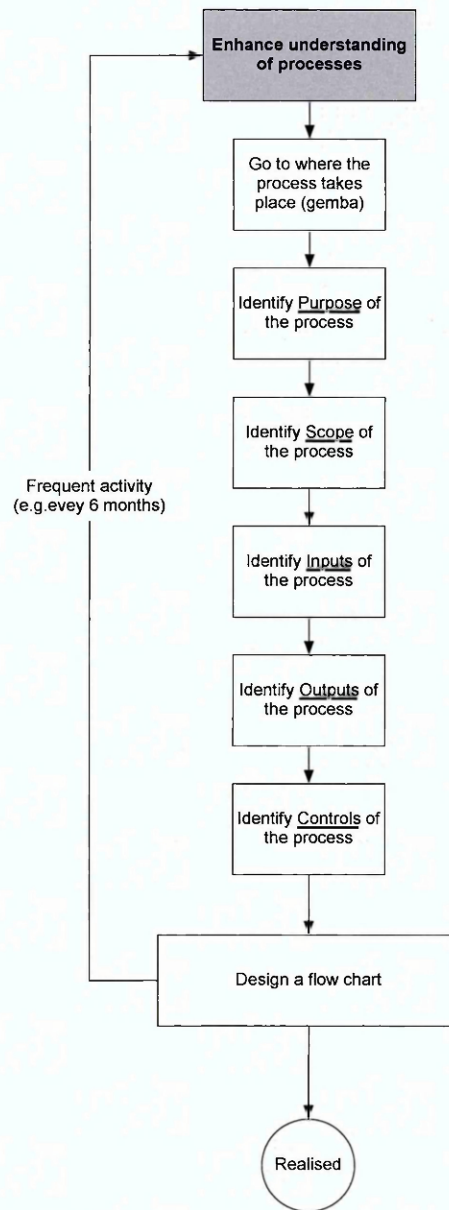


Figure 6.19: A Way of Understanding Processes

Figure 6.19 is built upon the findings of the American Productivity and Quality Center. To enable staff understanding of the processes they deal with, several elements have to be considered. First and foremost, in order to understand a process completely, it is crucial to go where the process takes place. Practitioners consider this step to be the most crucial step in any process improvement. Ignoring this step will result in wrong improvement initiatives, as the steps in the process have not been captured right. The next step is knowing what the purpose of the process is. Therefore, staff must question the existence of the process and be able to answer why the process exists. After knowing the

purpose of the process the scope gets identified. The scope of a process defines where the process starts, ends and what is included, excluded. It provides an overview of the process and sets barriers. Next inputs and outputs are identified. Inputs are characterised as anything that goes in the process and are transformed by the process in to the end service. Output is the result and is obtained at the end of the process. Finally, controls define what shareholders are expecting from the process and their influence.

Each of the mentioned elements of a process can be addressed by using several tools from the LSS toolset. Beginning with different communication techniques such as brainstorming or the active engagement at the gemba. Questioning the purpose of the process using 5 whys and information from data available, each element produces valuable information with which a status quo flow chart can be designed. Based on this flow chart, possible improvements can either be immediately identified (because of existing bottlenecks) or the redesign of the process can be planned. According to the experience of practitioners, processes frequently change and therefore need to be frequently checked (either every year or biannually).

6.5.5 Support Communication at All Levels

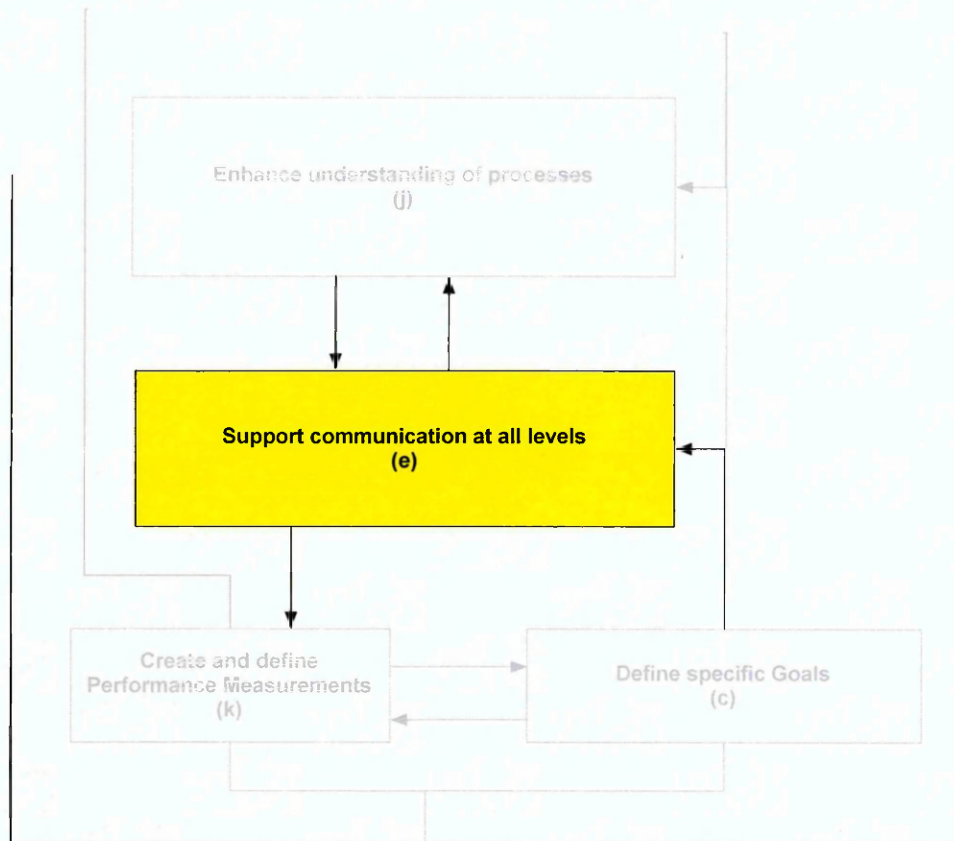


Figure 6.20: SLSS - Phase C: Support Communication at All Levels

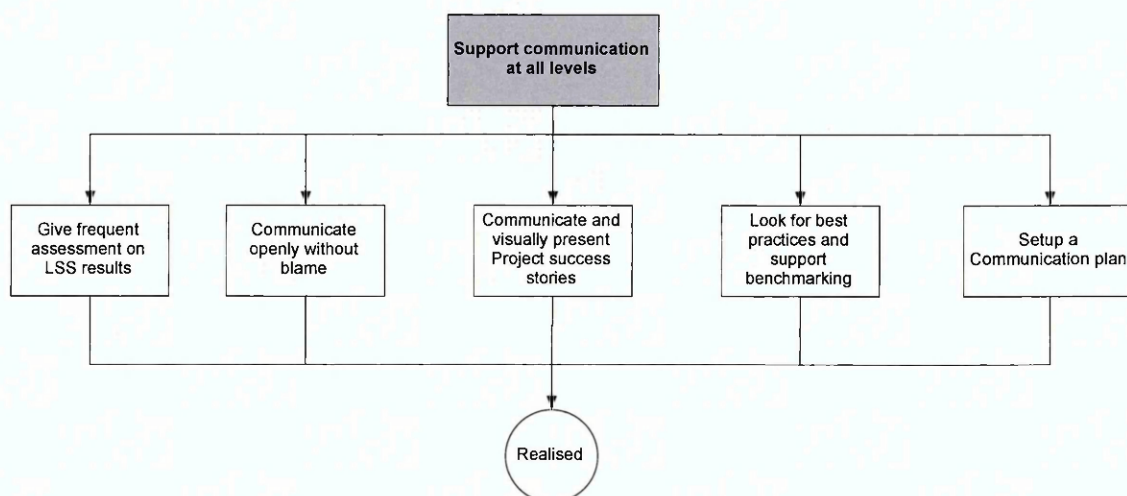


Figure 6.21: What to Consider for Communication at All Levels

"Communication at all levels" and "understanding of processes" are (according to the results from Chapter 5) both on the same level. Both have equal dependence power but differ in driving power. The only two factors that do not drive "communication at all levels" are "performance measurements" and "project management", both of which have no direct influence on "communication at all levels".

In Chapter 5 several barriers and ways to overcome them were discussed. Figure 6.21 shows the results of this discussion and input from LSS experts. The elements in Figure 6.21 do not follow a specific order. Each element can be addressed separately, however every element has to be considered.

Giving frequent assessment of LSS results is beneficial for a sustainable LSS in the hospital. It allows staff to be up-to-date on goals and achievements. Next in line to consider is a blame-free work environment. It has been widely discussed throughout cases that a blame-free working environment enhances improvement, as staff members are more motivated and willing to speak up when the code of conduct is ignored or mistakes at work happen. Royal Bolton Hospital has vigorously addressed this issue by forcing nurses to report a minimum of three mistakes per week. Such compulsion was initially necessary as nurses were reluctant to report mistakes, as it was hitherto seen as whistle-blowing. Communicating openly without blame leads to faster root-cause analysis and alleviates the use of Six Sigma. Another element to consider is the visual communication of project success stories. Toyota discovered a high increase in workers' improvement and motivation due to the fact that they were proud to communicate their success to other companies and visitors. Toyota enabled them to share their project success stories on two A3 papers placed along the walls of the factory. Hospitals have followed this example and created small spaces for success story walls, mainly in the break room, to remind everyone of their engagement and success in projects.

All the above-mentioned elements have in common that they are based on best practices. Hospitals can only make good use of LSS by learning from those industries with many years of experience in the subject. Hence, hospitals have been organising visits with manufacturers such as Toyota or Nissan to learn the

principles and find out if it would work in a non-manufacturing environment. In addition, hospitals, which were at the forefront of LSS activities now act as best cases for other hospitals willing to use LSS. This trend is supported by the increasing use of benchmarking in healthcare. Hospitals that have integrated parts of LSS are openly communicating their experience and challenges with LSS and are contributing to benchmarking. Finally, the setup of a communication plan introduces a standardised approach towards communication and contributes to a sustainable LSS. The communication plan would include the staff members' roles, responsibilities and instructions about what to do at work. A nurse would for example receive the instruction to read the shift reports from previous shift and day and verbally communicate between shifts, rather than just leaving work right away.

6.5.6 Create and Define Performance Measurements

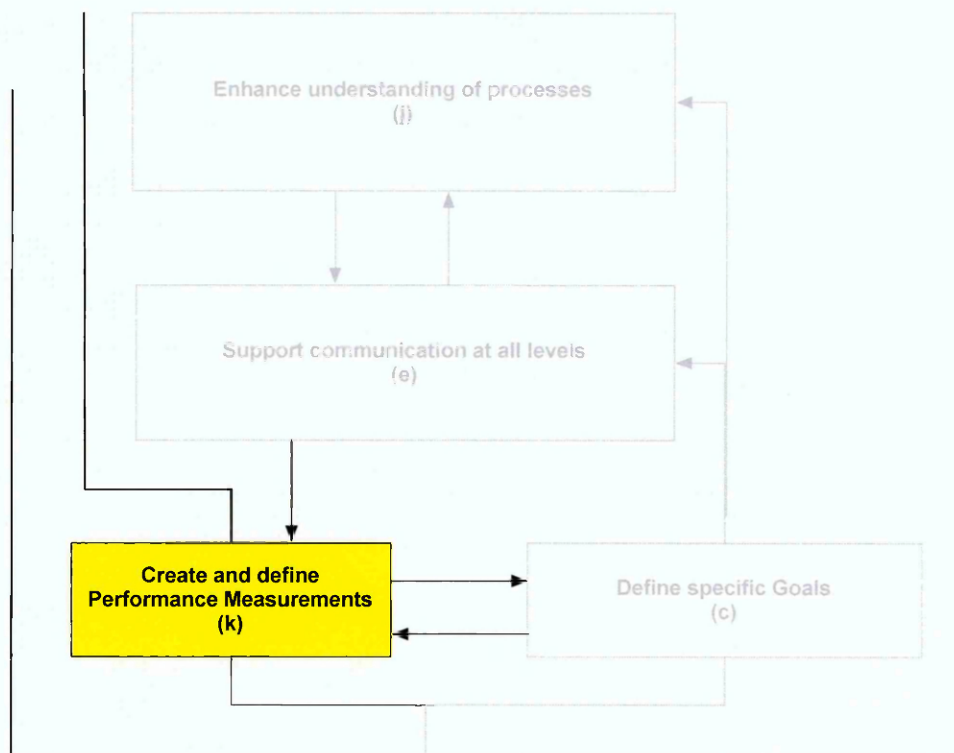


Figure 6.22: SLSS - Phase C: Create and Define Performance Measurements

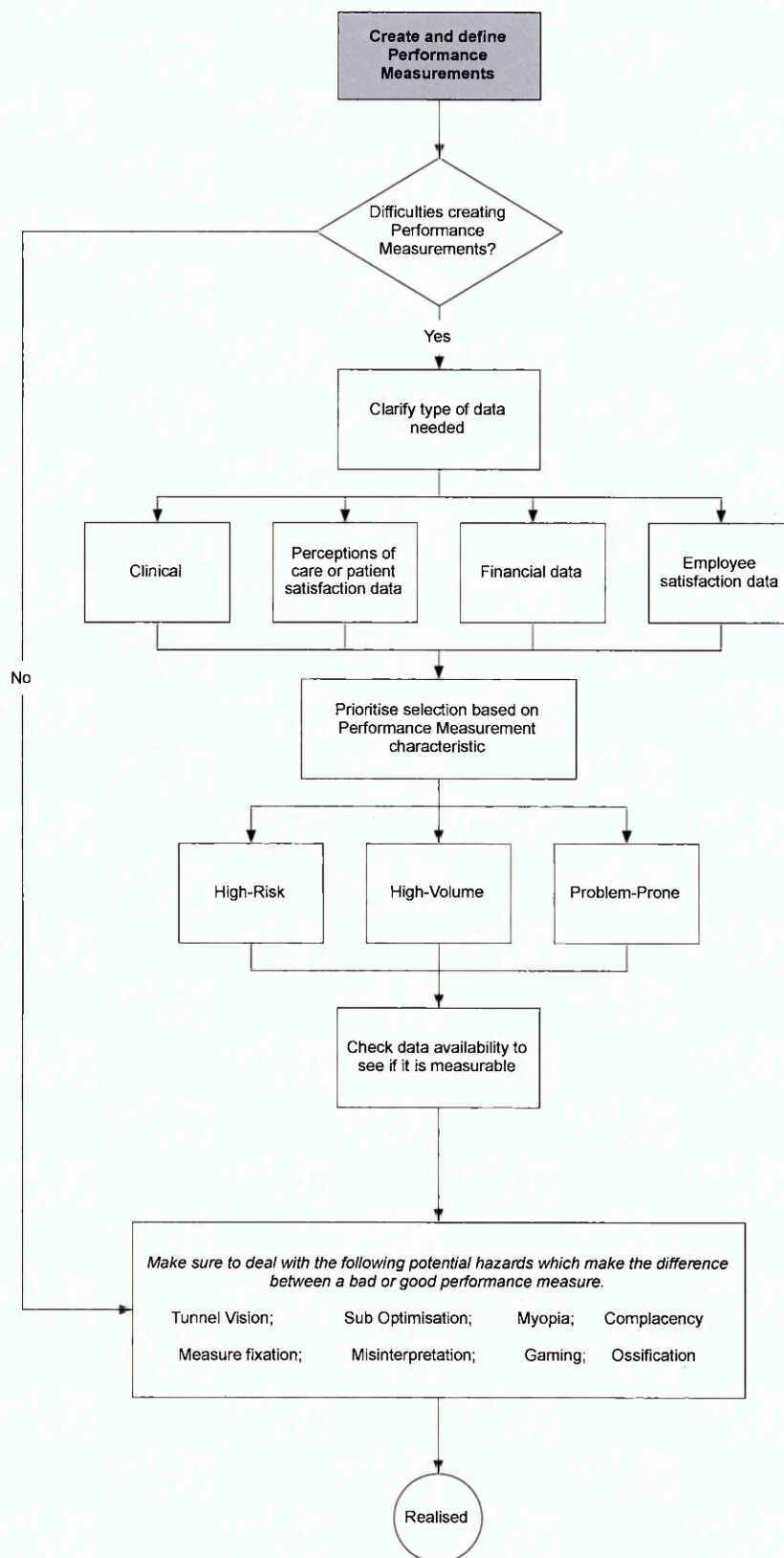


Figure 6.23: A Way of Creating and Defining Performance Measurements

The information provided is derived from a detailed literature review and the input from experts. The opinion of experts has lead to the creation of a data type table presented in Appendix B.

Prior to creating performance measurements (PMs) it is crucial to define what type of PMs is wanted. Figure 6.23 presents four types of data relevant for hospitals. Appendix B explains and provides examples of PMs for each data type. For example, if a hospital knows that it needs to create more clinical PMs it will shift focus on areas where PMs are sparse.

After clarifying the type of data, deciding what specifically to measure comes next. A prioritisation takes place based on PMs characteristics, which are categorised under High-Risk, High-Volume, and Problem-Prone PMs.

High-Risk	High-Volume	Problem-Prone
HIV/AIDS patients	Dementia patients	Post transplant care
Newborn (especially low-birth-weight)	Emergency triage services	Surgical site infections and wound care
Oncology patients	Patients with chronic conditions (e.g. diabetes)	Timeliness of diagnostic testing results
Organ donation and transplantation	Patients with Flu	Use of high alert medications
Suicidal patients	Waived testing	Verbal and telephone orders
Surgery process	X-rays	Waiting times for ambulatory care or ED treatment

Table 6.1: Performance Measurements Characteristics for Prioritisation Purposes
(adapted from Joint Commission 2008b)

Table 6.2 illustrates examples of populations and processes common in a hospital. A surgery process is categorised as a high-risk activity and is important for the hospital in case of delivering good service to the customer and avoiding legal repercussions. Hence, PMs should be created to monitor the surgery process. In case the hospital still faces difficulties in creating PMs it can look for populations or processes with overlapping characteristics (e.g. processes that have high-risk and are problem-prone). Taking the three characteristics into account it is imperative to use a framework that "ensures

balance across strategic improvement areas and guides the measurement process" (Adair et al. 2006, p. 61). This type of framework is referred to in literature as multi-dimensional or portfolio approach. Adair et al. (2006) identified eight frameworks that met the criteria, including non-financial and financial measures. The most known framework is the Balance Scorecard (BSC) created by Kaplan and Norton in 1996. The BSC is a management system that supports organisations specifying their vision and strategy, resulting in clear objectives and measures.¹ Taking into account the three characteristics, a BSC can be created and filled with PMs falling into one of the characteristics. By prioritising according to the three characteristics, PMs created for the sake of measuring will be reduced.

In addition to checking the data type and characteristics of PMs the availability of data is mandatory to check whether it is measurable or not. To measure the outcome of processes in healthcare is a challenge that many cases report. Either the outcome is very qualitative and cannot be measured precisely or no data is available to measure the outcome. This problem occurs in business areas where humans are more involved in a process than machines; therefore it is difficult in such business areas to find right and complete data to create PMs.

After confirming the availability or possible creation of data the existence of potential hazards of PMs has to be clarified. The success of improvement will depend critically on the extent to which potential hazards are dealt with. Goddard et al. (2002) concluded the potential hazards shown at the end of the flow chart in Figure 6.23 (explanation is provided for each hazard in Appendix B).

Figure 6.23 also considers the case where there are no difficulties in creating PMs. In case PMs are created without much difficulties, going through the last step of the flow chart is still recommended, as PMs also suffer from hazards post-creation.

¹ For further reading on the topic of BSC refer to Adair et al. 2006 and Kaplan and Norton 1996, "Translating Strategy into Action-The Balanced Scorecard".

6.5.7 Define Specific Goals

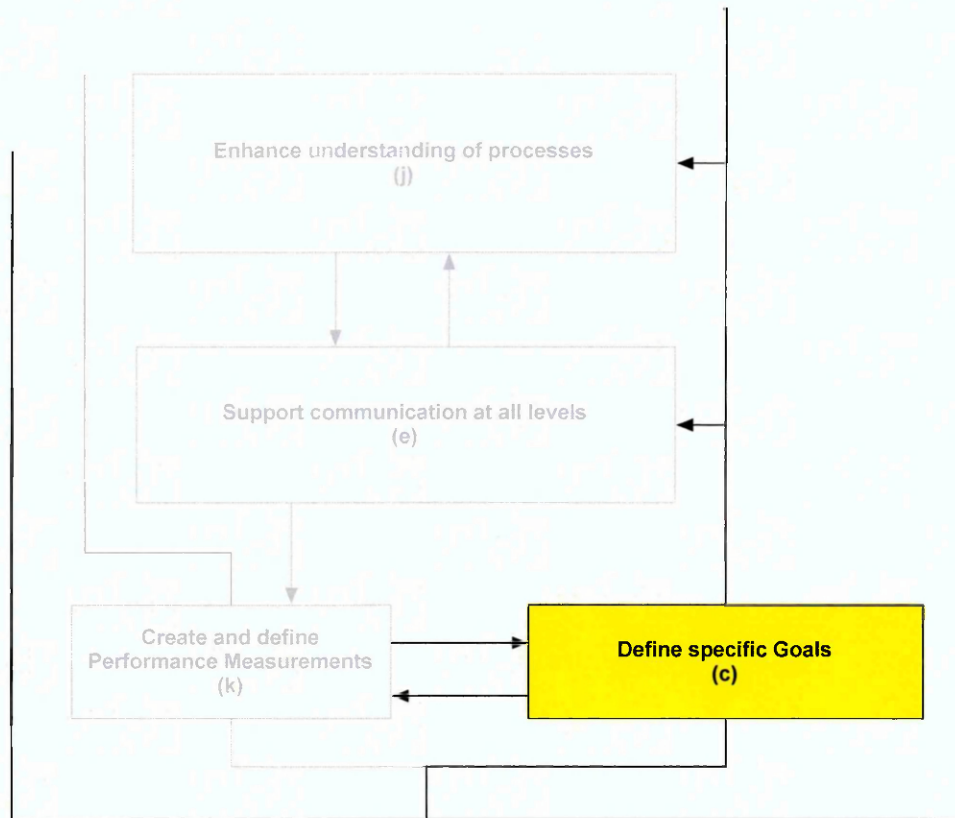


Figure 6.24: SLSS - Phase C: Define Specific Goals

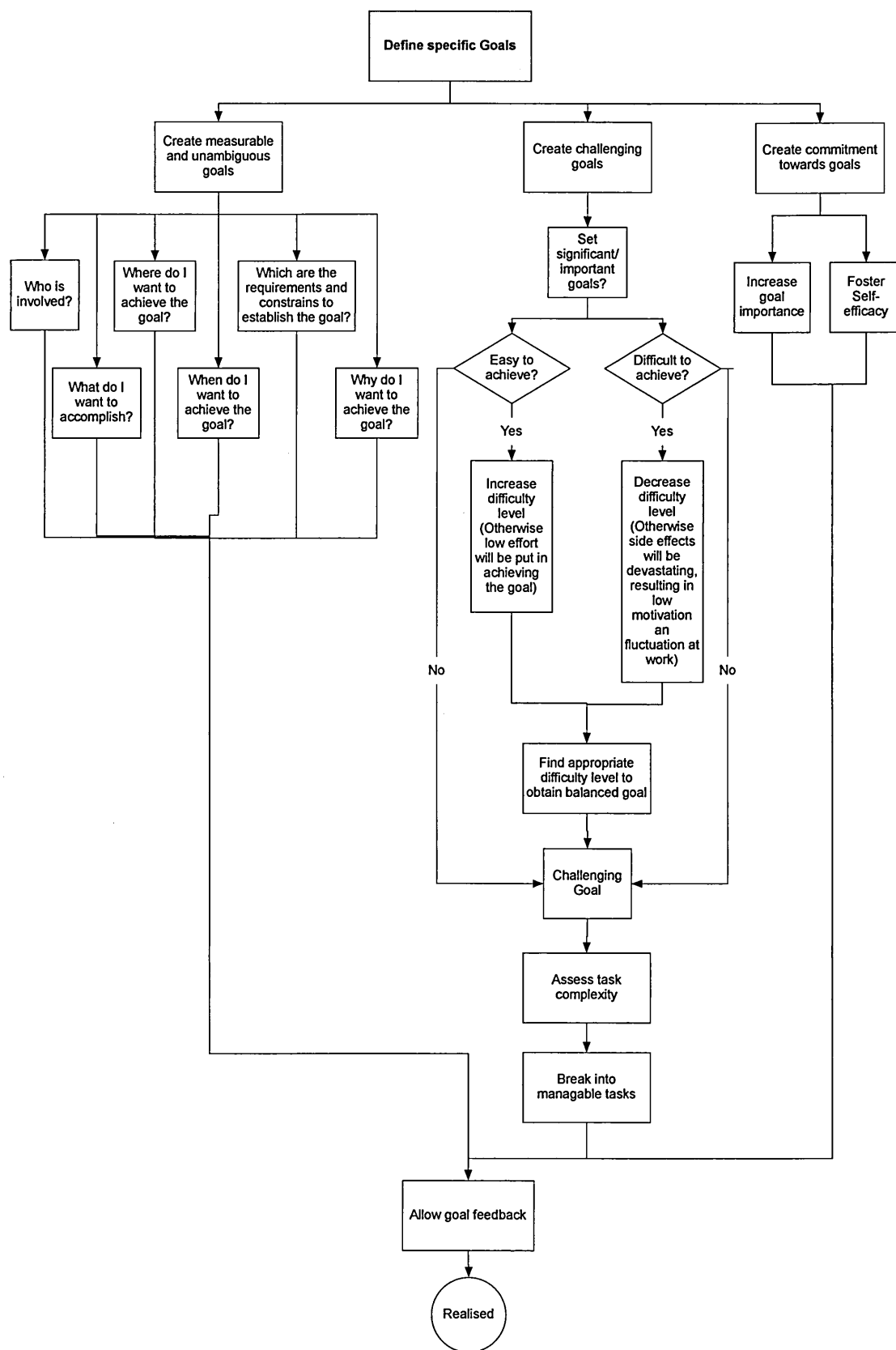


Figure 6.25: What to Consider When Defining Specific Goals

The results in Chapter 5 report that "goals" and "performance measurements" are on the same level, both with the second-highest dependence power after "project management". However, they differ from each other in driving power. "Goals" influences two more CSFs: "communication" and "understanding of processes". Both CSFs are interrelated with "goals", meaning that they will help achieve and be achieved by "goals". Specific goals will enhance communication across departments and at all levels, as they can be used as a common denominator and leave no room for interpretation. On the other side, good communication will help achieve the creation of goals that are unambiguous, challenging and manageable.

The elements of a well-defined goal are identical irrespective of the scope being on project or organisation level. Hence, many cases report difficulties during the implementation phase in projects caused by negligence to define goals that are unambiguous, challenging and manageable. Therefore, Figure 6.25 represents the detailed lessons learned from cases and the goal setting theory (discussed in Chapter 5).

Five crucial elements to a well-defined goal are considered and presented in three process flows. There are two reasons for starting the flow chart with three processes instead of with five. First, goal feedback is provided after all other elements have been considered. Feedback is given at the end to each element and the goal in its entirety. Second, task complexity can be best assessed after the creation of challenging goals. The objective of task complexity is to assess how the goal needs to be broken down into manageable tasks. There is no reason to do this at the beginning, as it needs the existence of a challenging goal.

In total six questions (who, what, where, when, which and why) were identified to address the creation of measurable and unambiguous goals. The answer to "Who is involved" and "Where do I want to achieve the goal" provide insight to who is accountable for reaching the goal. "What do I want to accomplish" and "Why do I want to achieve the goal" give ground to discussion on the necessity of the particular goal and allow shaping a measurable goal. In addition, the discussion will contribute to eliminating room for doubt and the creation of

ambiguous goals. Finally, the answers to the questions "When do I want to achieve the goal" and "Which are the requirements and constraints to establish the goal" will provide time-orientation and structure. "When" will provide the goal with a deadline and "Which" will provide structure by assessing what is and what is not possible.

A measurable and unambiguous goal can only be successful if it is challenging. An easily achieved goal will harm continuous improvement, as low effort will be put into achieving the goal. On the other hand, a difficult goal will have negative side-effects on staff members' motivation and lead to high fluctuation. It is therefore necessary to find the appropriate difficulty level to obtain a balanced goal. A common way to create challenging goals is to set the goal higher than the best previous performance. That only works if the previous performance was difficult to reach and the organisation had the same circumstances as the status quo. Another way to indicate whether the goal is challenging is to assess the task complexity. If the tasks are too complex and are difficult to manage in the time frame, the goal will eventually need to be revised.

Before providing feedback on the goal progress it is crucial to create commitment towards the goal. Hence, it is recommended to increase the importance of the goal. This can be achieved by communicating a sense of urgency towards achieving the goal. In addition, fostering and increasing the level of self-efficacy of a person has shown to contribute towards the goal commitment. Self-efficacy (level of belief in one's capability to successfully perform a particular task) can be fostered by ensuring the delivery of adequate training or by building up the confidence that the person can attain the goal.

Finally to make the goal effective staff needs feedback that reveals progress in relation to their goals. It is necessary to provide feedback to staff for them to adjust their level of effort or direction to match what the goal requires.

All five elements taken into consideration will guarantee the creation of well-defined goals.

6.6 Phase D

Phase D represents the CSF that has no initial impact on a sustainable LSS. In case all prior phases have been followed and addressed entirely the integration of LSS is on the best way to be a success. Although each factor in phases B, C and D are critical to a successful integration, the factor in Phase D has a delayed impact on the integration, meaning that once all CSFs in phases B and C are addressed, the integration of LSS seems successful. However, if the CSF in Phase D is neglected, the integration will fail in the long-term.

The CSF in Phase D has an absolute negative ratio between driving and dependence power. It has absolutely no driving power, meaning that it does not influence any of the other CSFs but totally depends on them. The challenge in this phase lies in the fact that this CSF can be neglected at the beginning of the integration but needs to be focused on towards the end of the integration. Furthermore, this phase is special as it has a different scope than the other phases. It separates the organisational scope from the more detailed project scope. From Phase A to B and C, the focus of the CSFs is on how to integrate LSS into the organisation in its entirety. Phase D differs insofar as it focuses on the requirements set at project level. As a consequence, if few projects fail due to ignoring Phase D, this will not have a direct impact on the integration of LSS on an organisational level. However, if more projects fail the integration will suffer and eventually fail.

6.6.1 Follow Rules of Project Management

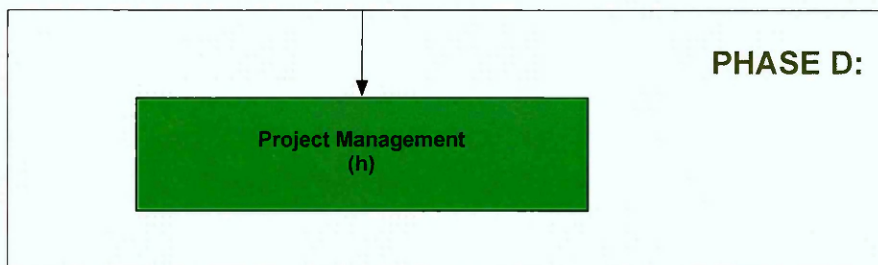


Figure 6.26: SLSS - Phase C: Follow Rules of Project Management

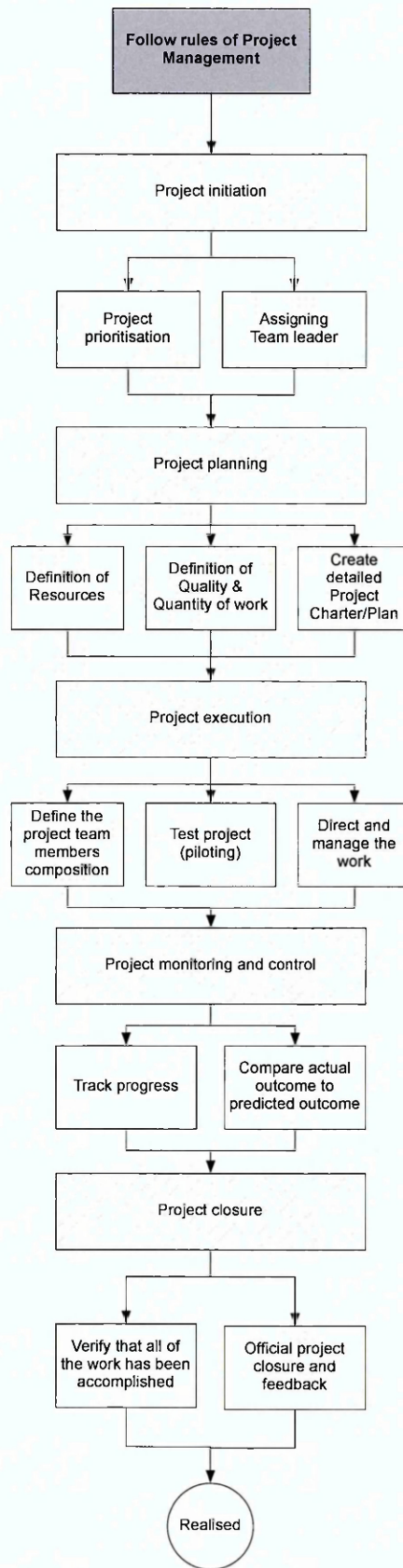


Figure 6.27: Components of a Successful Project Management

Project management (PM) has been identified as a CSF with no driving power, thus being the factor to focus on at the end. Nevertheless, it is a crucial factor for the successful integration of LSS, as without it the management of projects would fail, resulting in project failures. The outcome would be unmotivated staff not willing to follow the principles of LSS anymore and losing trust in the ability of top managements to make right decisions (resulting in the "another process improvement fad" attitude reported in chapters 4 and 5). It becomes clear that this CSF needs special attention in order to not lose all the effort invested in focusing on the other CSFs.

Figure 6.27 provides information on how to successfully manage projects by following a set of rules. These rules are abstracted from the PMI project management framework, which is a standard followed in the US. Like other flow charts provided in this Chapter this flow chart can be substituted with the most preferred framework, in case of UK, PRINCE2 project management framework might be used if wished. The framework is build on the following elements, which have to be followed consecutively:

- Project initiation
- Project planning
- Project execution
- Project monitoring and control
- Project closure

At the onset there are several projects that need to be prioritised and a project needs to be identified together with the assignment of the team leader. This is part of the initiation step. After this step the planning phase begins, during which resources have to be defined and allocated, the quality and quantity of work has to be established and ultimately a project plan has to be created. This phase is important for further success of the project. As reported in Chapter 2, many projects in LSS fail due to mismanagement, as the planning phase was not sufficiently well thought-through. Next is the execution of the project, whereby multidisciplinary project teams are composed, the project is piloted and tasks are managed according to project plan schedule. After project execution the monitoring and controlling of the project's progress takes place where the actual

outcome is compared to the predicted outcome. Finally, the project ends with the closure, wherein the work done is verified and feedback is provided. Several cases report this last step being omitted or neglected, hence practitioners and researchers highlight the need to celebrate the closure of a project and not to simply forget it. The celebration of the project's closure is a sign of gratitude towards the effort staff put in and increases their motivation to do better in future projects.

6.7 Conclusion

This chapter set out to present the SLSS framework based on findings from prior chapters. The framework includes four phases, which have to be followed consecutively. Phase A describes the initial assessment phase of the integration, where forces and resistance to change have to be assessed. This step allows the assessment whether the integration has a good chance to succeed. Phases B, C and D represent the core elements of the framework, namely the CSFs. Although all CSFs are by definition critical this chapter has provided a framework that follows a specific structure implying that some CSFs have to be focused on prior to others.

- Phase B focuses on CSFs that are essential for starting the integration.
- Phase C is made up of CSFs, which are unstable and can endanger the integration. This phase needs special attention in order to not let the integration fail prematurely.
- Phase D has a delayed impact on the integration. Although integration will not suffer immediately if the phase is neglected, there are negative long-term effects.

The SLSS framework concludes with Phase D, which represents the end of the organisation scope and the beginning of the implementation of LSS on project level. Furthermore, SLSS includes possible solutions addressing each CSF and a description is provided for guiding healthcare professionals to integrate LSS in their organisation. The SLSS framework presented in this chapter is not final, as no validation has taken place. Hence the next chapter will address this issue and provide the final framework.

CHAPTER 7:

EVALUATION OF THE FRAMEWORK

7.1 Introduction

In Chapter 5 all CSFs were described, and in Chapter 6 possible approaches were provided on how to address each element of the SLSS framework. The framework was built on an extensive literature research and quantitative and qualitative methods presented in prior chapters. The final step is to validate the framework. There are several methods for this purpose. The framework is either validated in a quantitative, qualitative or mixed way.

In the following the validation of the framework is presented and changes are proposed. The framework is validated by semi-structured interview and the inclusion of attributes from the theoretical validation method (the latter of which is referred to in Section 7.2), and the reason for choosing semi-structured interview and the results of the interview are presented in sections 7.3 and 7.4. Finally, the refined framework is discussed and shown in Section 7.5.

7.2 Theoretical Validation

A common approach of validating results of a framework is by using quantitative methods. Surveys are created in order to obtain data able to validate the elements of a framework. The sample size therefore plays a crucial role and should be large. How large the sample size should be depends on guidelines from prior research for similar frameworks. Taking ISM into consideration, a quantitative approach is widely reported throughout the literature. In fact, the majority of papers using ISM have discussed this topic, however without delivering any validation results. Singh and Kant (2008) argued that Structural Equation Modelling (SEM), also referred to as linear structural relationship approach, is capable of testing each element of the ISM. However, it is important to note that SEM cannot develop an idea (model) itself. ISM on the other hand has the capability of developing a model based on managerial techniques. In addition, SEM demands a big sample size of at least ten participants per tested element (Hoe 2008); it is common to look at a sample

size bigger than 200 (Hox and Bechger 1998). This is difficult to achieve in the context of this study, as the population needs to fit in the requirements of working in a healthcare environment and using Lean Six Sigma. The SEM sample size does not correspond to the common sample size of surveys in the LSS area of 50-100 (Langabeer et al. 2009). In addition, a more detailed and in-depth analysis of the framework was preferred rather than generalisability and frequency. These arguments and the time constraints of a three year PhD have led to the choice of a qualitative approach to validation.

Although papers on the theoretical validation of frameworks are in the minority compared to more active methods such as interview or observation, they deliver good results in analytically validating frameworks. Theoretical validation is based on a set of attributes that researchers over the years have collected and identified to describe the counterparts (quantitative) validation. The validation process can either be done by the researcher himself or be included in questionnaires (Dellinger and Leech 2007). Van Belle (2004) personally validated his framework that focuses on the evaluation of business models. He identified a list of attributes, including: construct efficiency and simplicity; coverage and completeness; orthogonality; extensibility, customisability, robustness and flexibility. He then addressed each attribute in detail by referring the components of his framework.

This research made use of theoretical validation in conjunction with the semi-structured interview method. The attributes of the theoretical validation were obtained from Tobin and Begley (2004) and Van Belle (2004). The attributes were transformed into questions following Kitson et al.'s (2008) approach.

7.3 Evaluation by Interview

As discussed in 7.2, a validation based entirely on theoretical means was dismissed. A complementary approach was chosen to include the attributes into a questionnaire. The questionnaire was delivered by semi-structured interview. This method was identified to be most beneficial. First, the researcher wanted to ask a predefined set of questions build on the above-mentioned attributes,

hence the unstructured interview method was out of the question. Second, there was no need to structure the attributes in a chronological way. The researcher needed to be flexible and adjust the sequence of questions according to the interviewee; hence a structured interview method was not practical.

7.3.1 Questionnaire design

The questionnaire was designed based on research conducted by Tobin and Begley (2004), Van Belle (2004) and Kitson et al. (2008). The questions were open-ended only and followed no particular sequence. The average interviewing time was 45 minutes and included discussing each question and the practical applicability of the framework

The following six questions were asked and discussed:

- *In your opinion, have all elements for sustainable LSS been captured?*
- *In your opinion, do you agree on the order of priority (structure)?*
- *In your opinion, is the framework easy to understand?*
- *In your opinion, is the framework transferable?*
- *In your opinion, does this framework help to achieve sustainable LSS?*
- *Do you have any suggestions for improvement?*

7.3.2 Background to Interviewees

Five practitioners and researchers were asked to provide their input to the proposed framework. In order to guarantee broad and rich information, the distribution of practitioners coming from the healthcare and service industries were even. Two practitioners from each industry with over 10 years of work experience with process improvement (in particular LSS) and one academic (with excessive business case experience with LSS in both industries)

participated in the interviews. Figure 7.1 presents the work experience of each interviewee (the symbols A, S and H refer to the industry participants are from, namely the academic, service and healthcare industries respectively).

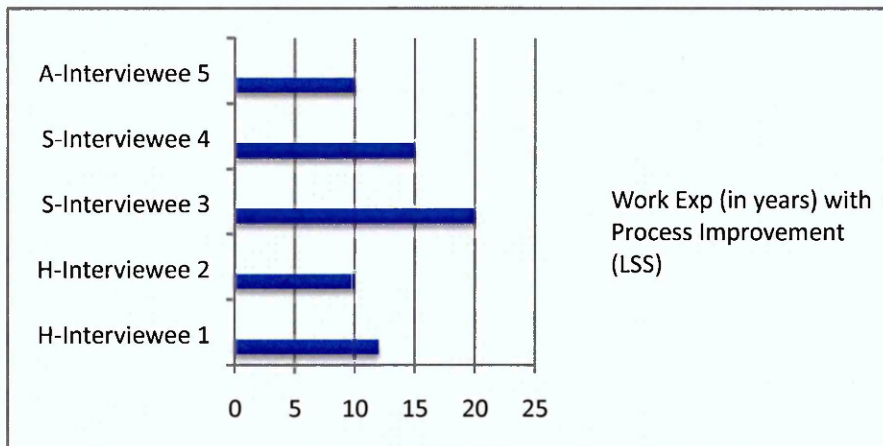


Figure 7.1: Interviewee's Work Experience

The Interviewees were considered suitable due to their long and practical experience with LSS. The Interviewees from the service industry both are certified Master Black Belts and hold leading positions in their organisation. Over the years they made the transition from TQM to LSS and have experience with the change process of organisations.

The healthcare interviewees have similar experience. Both are certified in LSS (GB and BB) and have experienced the rapid change in process improvement approaches throughout healthcare. One interviewee works in the American healthcare sector and has early gained experience with LSS. The high amount of healthcare cases published before 2000 in the U.S. is evidence for an early focus on LSS compared to Europe. Considering this fact it was seen as beneficial for the validation to involve someone who went through the early beginnings of LSS.

Finally, the researcher participating in the validation process was chosen due to his experience with the NHS and SMEs regarding the sustainable use of LSS. He has published over 20 papers in this area and has considerable experience with organisations failing to sustain process improvement approaches such as LSS.

7.4 Results & Proposed Changes

In your opinion, have all elements for sustainable LSS been captured?

According to four out of five interviewees, all CSFs for a sustainable LSS were captured in the proposed framework. Nevertheless, one out of five argued that there might be more CSFs, which were not captured. In particular "leadership skills" was seen as an important factor to sustain LSS in an organisation, as it provides insight in whether the managers are capable to translate the vision into daily work. Therefore leadership skills was proposed to be part of the framework, either as a CSF or included in "top management commitment".

In your opinion, do you agree on the order of priority (structure)?

This question created cause for discussion as the structure of the framework is built mainly on the results from ten professionals analysed with the ISM method. Consequently, three out of five agreed to the structure, and two out of five were unsure. In particular, the discussion evolved around each element's position in the framework and not the phases. The phases of the framework met with total agreement, as they were clear and the sequence left no room for discussion. Phase A was seen as the initiation step, Phase B included CSFs that were seen essential for the beginning of every change initiative, Phase C prepared for a stable and continuous improvement and Phase D was interpreted as the start of improvement projects.

Two out of five were questioning the positioning of every single CSF, as one Interviewee stated: "I do not know why communication is positioned so low in your framework". Therefore, this major critique was taken into account and inspected further.

In your opinion, is the framework easy to understand?

Four out of five stated that the framework is easy to understand and that the description provided is good. The framework presented to the Interviewees can be viewed in Appendix D. One interviewee had difficulty understanding the

framework and stated that the arrows going in all directions in PHASE C were confusing. In fact, he was expecting to see a sequence of factors, which had to be followed step by step with few arrows. In addition, the description did not explain the issue with the arrows very well.

This critique was considered and addressed together with the critique on the structure.

In your opinion, is the framework transferable?

Clear agreement was met at the question regarding the transferability of the framework. All stated that the framework could be used in other industries. An interviewee from the service industry replied that he could very well imagine using the framework in his line of work.

This outcome was expected as the CSFs of LSS originated from the manufacturing industry and other industries were adopting the approaches taught to them by manufacturing professionals.

In your opinion, does this framework help to achieve sustainable LSS?

Further agreement (unanimous) was met on the fact that the framework helps to achieve sustainable LSS. It was stated that the framework depicts the level of focus very well. Meaning that it starts from an organisational point of view and ends with the beginning of projects. The A-Interviewee stated that he could imagine this framework helping top management to sort out ideas and focus on what is important, getting the basics straight prior to starting projects. An organisation using this framework would think twice before embarking unprepared in improvement projects.

Furthermore, the additional approaches (discussed in Chapter 6) provided to each element of the framework were perceived as very useful for top management new to this subject. On the other hand, for top management with experience in the subject the additional information might not be relevant, as they would have their own approaches on how to address each CSF.

Do you have any suggestions for improvement?

A few small suggestions were provided on how to improve the framework. In general, most of these have already been discussed under each question above.

A suggestion was provided on how to further enhance sustainability in the framework. A loop should be included going from the last phase (D) to the second phase (B), signalling that the process has to be repeated frequently (yearly). This will allow management to be on-track and not let any drive towards change fade. The interviewees stated that in service and other (manufacturing) industries this can easily be done every year, as the Balanced Scorecard is in place to check on KPIs, which in turn will help to generate sense of urgency. The loop should be visually represented in the framework and not perceived as common sense.

Another concern was stated for the first phase (A). The phase has no requirements for entering the next phase, meaning that organisations with more resistance to change than driving forces could technically proceed to the next phase and start the integration. Although this is right, the framework provides approaches to reduce resistance to change and increasing driving forces to change. The change path thereby works as a monitoring tool in order to show management in which direction the organisation is steering and what can be done to bring it back on course. There is only one path that does not allow the organisation to proceed with the integration. In case the organisation cannot manage to reduce the resistance and they do not present opportunities (meaning they can not be changed at a later point during the change) the integration cannot start without help from outside. Hence this suggestion was not included in the final version of the SLSS framework.

7.5 Refined SLSS Framework

All suggestions were considered and addressed. Suggestions which benefit the framework are considered below. The SLSS framework presented in Chapter 6 was edited and the final framework is presented in Figure 7.2.

Primarily, small adjustments were made to the framework, with the exception of a big change resulting in the exclusion of arrows in each phase. This seemed necessary in order to enhance simplicity. The arrows originated from the ISM, which was completely transferred to the framework and attached to Phase A. Phase C caused particular misunderstanding, as arrows were going in every direction, illustrating the complex relationship between each CSF. For a better understanding of the framework and to increase usability, the arrows in each phase were ultimately erased. Nevertheless, the structure in each phase was retained.

The second change to the framework was based on the suggestion to visually highlight sustainability. From chapters 2, 4, 5 and 6 it becomes clear that the framework is created to support sustainable LSS. In addition, the description provided to the framework also highlights this fact. The chapters also explain that addressing each CSF is not a one-time thing but needs to be done frequently in order to monitor progress. Despite all this, it is true that this important fact is not visually illustrated in the framework. Hence, a loop was added indicating that SLSS should be used on a frequent basis (e.g. yearly or every half a year). Contrary to the suggestion from the interviewees, the loop does not go to the second phase but to the first phase. Arranging the loop only between phases B and D would mean that the focus lies entirely on the CSFs. However, as change takes place the organisation needs to be up-to-date on the resistance that exists in the organisation, and respectively which change path they are taking. Considering these facts the loop was closed between the last (D) and the first (A) phase.

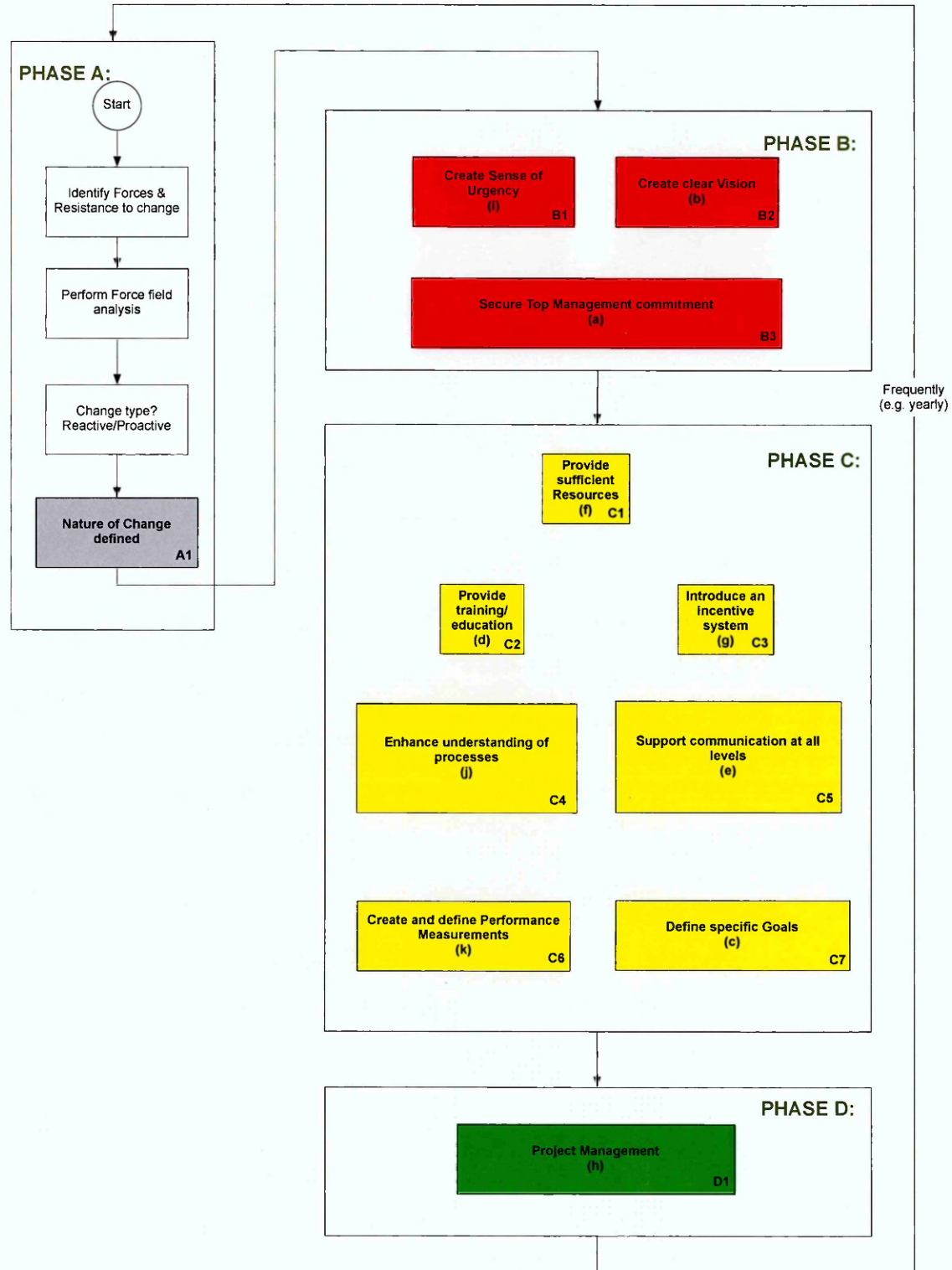


Figure 7.2: Final SLSS-Framework

7.6 Conclusion

The framework was very well accepted and was seen as a contribution to the field of process improvement, which was missing a stronger focus on sustainability. The results from the interviews were positive towards the framework. The transferability, reliability and usability of the framework in particular were highlighted. The framework can be used in other industries, as the components can adapt to new environments. SLSS also does what it is supposed to do, namely support the integration of LSS in an organisation. In addition, the approaches provided to each element of the framework were described as very beginner-friendly. Discussions were mainly caused by the preset structure of the framework. Some interviewees did not agree with the positioning of CSFs, as some were positioned too low in the structure, indicating less influence. The arrows indicating the relationship between the CSFs were also misunderstood. Arrows were interpreted as a way to illustrate a sequence, hence the arrows pointing in different directions added to the confusion. The positioning of the CSFs was not changed as they were obtained through ISM and did not go against common sense. The constellation of CSFs in phases was also kept, however the arrows were erased to enhance simplicity. In addition, a loop to symbolise sustainability was added to the final framework.

The validated SLSS framework allows organisations to focus on the strategic aspect of business. It is designed to complement frameworks focusing more on the operational aspect of business. Frameworks such as PDCA or DMAIC and their many extensions can be used to address LSS on a project level and be complemented by SLSS focusing on the strategic level. The changes made to the SLSS framework further enhance its focus on sustainability and user-friendliness.

CHAPTER 8:

CONCLUSION, IMPLICATION AND FUTURE RESEARCH

8.1 Summary

The biggest healthcare system in the world, the National Health Service (NHS) has been promoting the use of process improvement approaches since 2000 under a 10-year modernisation plan spearheaded by the government. There are several applications where process improvement approaches, in particular Lean and/or Six Sigma, have been successfully used. However, the implications of using such approaches on a project level have led to hospitals not sustaining their benefits and partially going back to the way things were before. Therefore, having realised the benefits of using Lean and/or Six Sigma (L/SS) to address specific issues, organisations in the healthcare sector are attempting to integrate L/SS in order to achieve long-term continuous improvements. However, only a few hospitals have managed to sustain process improvement efforts (e.g. RBH, VMMC). Those organisations have focused attention on integrating the principles of Lean Management and mostly disregarded Six Sigma. To reap the full benefits of Lean Six Sigma, it is necessary to develop a systematic approach to integrate Lean Six Sigma in healthcare organisations.

Following the findings provided in the literature review (Chapter 2), the need for such a systematic approach was identified and next steps in this research were planned and designed. At the onset it was clear that this research would benefit from both quantitative and qualitative approaches; hence different data collection methods were chosen to create a mixed-method approach. A survey was conducted and presented in Chapter, 4 in order to find out how hospitals cope with L/SS and to assess the underlying reasons for hospitals not sustaining their improvement approaches. The findings generated were crucial for the direction of this research. Apart from an overemphasis on Lean rather than Six Sigma (covered in the literature review findings), it became apparent that several factors were not properly addressed. These factors were repeatedly reported as critical for a successful use of LSS in literature.

Based on this insight, the researcher was determined to conduct a thorough literature review on the topic of critical success factors of LSS. After reviewing

many papers from different areas and industries, the focus was put on papers referring to LSS and a healthcare environment. As not many papers were available according to those premises, papers with no specific industry focus were considered. Chapter 5 presented those findings and identified a total of eleven CSFs. The barriers of successfully addressing each CSF were introduced as well as the ways to overcome them. The common knowledge is that each CSF (as the name implies) is critical, and is therefore seen as equally important and influential. Knowing that those elements would constitute the proposed framework, the researcher was facing the challenge to build a structure out of the CSFs. The objective was to use a method in order to create a simple structure based on the relationship of those CSFs. Hence the ISM method was determined as a sufficient method to fulfil the objective. Ten experts from different industries were asked to participate in pair-wise comparison of each CSF according to the contextual relationship "will help achieve" (e.g. well defined goals "will help achieve" understanding of processes). The outcome was a model presented in Chapter 5 (Figure 5.1) representing a hierarchical order of CSFs according to their driving and dependence power. The subsequent MICMAC analysis revealed that three consistent groups emerged consisting of all CSFs. Those groups represent three of the four phases of the proposed framework.

Further research into existing frameworks from a change management perspective revealed the need to initiate change by first assessing the readiness of the organisation. How ready is the organisation regarding resistance and forces to change? What type of change are they pursuing? What happens when the type of change alters? Those questions were to be answered at the onset of every change initiative. Hence, the definition of nature of change was included as the twelfth element into the framework and represented the first phase. Chapter 6 presented the proposed framework and provided approaches to address each element. The provided approaches were built both on best practices from literature and discussions with practitioners.

The framework was developed based on solid and comprehensive literature review, survey and input from practitioners. However, the framework was not yet validated. As a consequence, five experts with over 10 years of experience

with LSS were interviewed. The framework was regarded as very practical and useful as a support for healthcare professionals. Some minor changes were proposed which were assessed by the researcher as useful and non-contradicting best cases. A few changes were applied to the framework and the final framework was presented in Chapter 7.

8.2 Research Objectives and Achievements

This section addresses each objective presented in Chapter 1 and the achievements made by this research. The results are illustrated in Tables 8.1 - 8.5.

Research Objectives	Chapter	Findings
Conduct a thorough literature survey to identify recent developments and research work undertaken in LSS.		
Level of integration of LSS in the healthcare sector?	2	<ul style="list-style-type: none"> Cases of implementing LSS in healthcare organisations are widely available; the focus here lies on the <u>implementation</u> process itself, involving extensive tools. There are very few cases of successful <u>integration</u> of LSS in healthcare. Hospital in the Netherlands successfully managed to integrate aspects of LSS; here too, the focus was on implementation. Hospitals that have successfully integrated process improvement approaches: Bolton Hospital and Virginia Mason Medical Center. However, both have integrated following the Toyota production system principles.
Can Lean and Six Sigma be equally implemented?	2	<ul style="list-style-type: none"> Significantly more cases are available on the topic of Lean implementation than the implementation of Six Sigma. Despite some Six Sigma cases in the NHS being available, the NHS has not started improvement with Lean. Due to a pilot project assessing Sigma level in the country, it was decided to initiate process improvement with Lean, as the current level was drastically low (2σ).
How sustainable is LSS?	2, 5	<ul style="list-style-type: none"> The healthcare typical variety of stakeholders and the different expectations: an inhibitor to sustaining LSS if they are not managed properly (e.g. goals should have input from all stakeholders, but the needs of the patient should be prioritised). Another often reported inhibitor is represented by the fact that many hospitals are inconsistent. As a consequence, one management philosophy (approach) has been introduced with little to no success in reaping sustainable benefits. BPR, TQM, CI, TOC etc. are approaches that were used there and then, but after a while. This is counter-productive and not sustainable. Managerial capacity is mentioned to describe commitment provided by management, without which no approach can be sustained. Other frequently mentioned inhibitors are the availability of right training and of appropriate data. The latter is particularly a barrier to benchmarking and improvement.

Table 8.1: Research Objective: Literature Review

Research Objectives	Chapter	Findings
Conduct a comprehensive survey to assess the implementation of process improvement techniques in the healthcare sector.		
What are the requirements set for the survey?	4	<ul style="list-style-type: none"> The population are healthcare professionals in hospitals. The sample consists of healthcare professionals from UK, Italy, Germany, Denmark and Netherlands The unit of analysis is the job position of the healthcare professional The healthcare professionals are supposed to have at least some knowledge of Lean and/or Six Sigma
What does the survey cover?	4	<ul style="list-style-type: none"> It covers questions regarding the implementation and acceptance of Lean and Six Sigma in hospitals Questions regarding a (premature) list of CSFs are provided in order to assess the integration level of Lean and/or Six Sigma.

Table 8.2: Research Objective: Conduct Survey

h Objectives	Chapter	Findings
survey and literature data to identify key reasons behind inability to sustain Lean Six Sigma.		
of integration of LSS	4	<ul style="list-style-type: none"> Lean has clearly been chosen as the most preferred approach. Six Sigma perceived as disturbing the improvement, as it demands more extensive training than Lean and is not beginner-friendly. Similar Lean and Six Sigma tools are used in hospitals, reported in previous literature. In contrast to what is reported in literature, the most preferred and used improvement methodology is PDCA, and not DMAIC. The demand for an approach to sustain LSS becomes clearer as several factors are neglected.
ing the status of	4	<ul style="list-style-type: none"> Top management commitment was reported (with a majority) to be moderate. No training was provided in Six Sigma, but some training in LSS. Lack of understanding how to define goals has been identified Project management rules are partially followed. The process of prioritising Projects does not always take place Communication is weak. Nurses are involved in improvement initiative to some extent. More than a quarter of participants report restricted communication, as information is not always shared with other departments. Staff is also not totally supported to report something is wrong, which works against a timely reaction to prevent mistakes
ing the usage of Six	4	<ul style="list-style-type: none"> Six Sigma is not used widely. No training was conducted in Six Sigma Six Sigma does not integrate well in every day work
ing tools used?	4	<ul style="list-style-type: none"> Similar toolset is used compared to other surveys published in journals Although, Six Sigma is not preferred, many of the top ten tools are, indeed, used
ing benefits achieved	4	<ul style="list-style-type: none"> Medical services and administrative processes seem to highly benefit from the implementation Improvement in quality is the most frequently reported benefit followed by cost reduction and improvement of delivery.

Table 8.3: Research Objective: Analyse survey and Literature Review

Research Objectives	Chapter	Findings
Develop a framework to support sustainable LSS in the healthcare sector		
Identify building blocks of the framework	6, 5, 2	<ul style="list-style-type: none"> The framework consists of 12 elements. 11 CSFs and one element representing readiness of the organisation to change, represented by Nature of Change. 11 CSFs were identified through literature and secondary data analysis, which were evaluated. Nature of Change was identified as important initial step for any change and was derived from several frameworks (Strebel, Lewin, Kumar 2011).
Structure of the framework	6, 5	<ul style="list-style-type: none"> According to common best practices Nature of Change was considered to be the first element of the framework. The CSFs interrelationship was analysed involving the input from ten experts. The analysis was used to obtain a structure in which CSFs -despite being all critical- differ in their level of importance and are ordered accordingly. The subsequent MICMAC analysis provided insight in how the CSFs are clustered. Three groups were identified by incrementing and decrementing the threshold by 0.1. The Framework is ordered in four phases: Phase A (Nature of Change) and phases B, C and D (each of the three groups identified from MICMAC)
How the framework provides support	6,7	<ul style="list-style-type: none"> By highlighting the need of practitioners to focus on factors that are critical for successful integration of LSS. By not launching the initiative blindly without knowing about the nature of change and its impact. By frequently following the phases in the framework, alongside the implementation of LSS projects.

Table 8.4: Research Objective: Develop Framework

Objectives	Chapter	Findings
and refine the proposed framework by interviewing LSS experts		
Components of the framework validated?	7	<ul style="list-style-type: none"> Semi-structured interviews with five experts, each having more than 10 years of experience with LSS. Common attributes of validated frameworks were identified and integrated in the questionnaire for the interview.
Elements of the framework	7	<ul style="list-style-type: none"> All elements are valid and contribute to sustaining LSS in hospitals. It is easy to understand and is a good support for healthcare practitioners who integrate LSS in their hospitals.
Framework need	7	<ul style="list-style-type: none"> In order to enhance understanding, some changes to the framework were done. The framework received a loop (from phase D to A) visualising an ongoing commitment with frequent (e.g. yearly) checks on the phases of the framework. The structure of the framework was left untouched, however the arrows were deleted in order to not confuse managers with arrows pointing in all directions. The essence of the elements is maintained, as each CSF keeps its position in the framework.

Table 8.5: Research Objective: Validate and Refine Framework

8.3 Contribution to Knowledge

This research has contributed to the knowledge of Lean Six Sigma in healthcare. It also contributed in a practical way by involving healthcare and Lean Six Sigma practitioners in all phases of the research.

- The main contribution of this research is the development of a framework, which supports sustainable Lean Six Sigma in healthcare. A literature review was performed to understand the need for developing a framework for supporting healthcare practitioners to integrate Lean Six Sigma in the healthcare sector. A clear need was identified and presented in Chapter 2.
- An empirical study was conducted involving the participation of 31 healthcare professionals with prior L/SS knowledge. The study complemented the findings in the literature review by highlighting the current preferences in European hospitals and their negligence towards understanding the factors that are truly critical to sustaining LSS.
- The research has made an attempt to identify the critical success factors (CSF) for sustainable Lean Six Sigma in healthcare organisations. Few research papers are available on CSFs for LSS. Additionally, there is no evidence in published literature that an attempt has been made to understand the interaction among these CSFs. The closest research paper to this topic focuses on barriers of Six Sigma implementation (Soti, Kaushal and Shankar 2011)
- In addition, CSFs are often integrated into models without understanding their relationships, hence not knowing which factors ought to be given more attention. This research provides a solution by creating a model based on the ISM method, which helps healthcare professionals understand the essence of CSF relationship and shift priorities (resources) accordingly.

- Based on all findings, two key components were identified which constitute the proposed framework: Nature of Change and CSFs. Nature of Change was derived from change management theory that every change in an organisation needs an assessment of the situation. Hence the framework starts with defining nature of change and continues with providing approaches to address each CSF for sustainable LSS.
- A key finding of this research is that "create sense of urgency" and "create clear vision" are significant CSFs. Both CSFs have the highest ratio between driving power (influence) and dependence power. In fact, no other factors influence them, indicating that if ignored sustaining LSS in the organisation becomes unlikely. Therefore, management should focus on developing these both factors to create a quality culture and the awareness that something has to change. Respectively, subsequent factors have to be dealt with according to their driving/dependence power ratio.
- Furthermore, this research illustrates that several CSFs arrange themselves in groups according to their ratio. Three clearly distinctive groups could be observed by MICMAC analysis:
 - *Group 1*: consists of "create sense of urgency", "create clear vision" and "secure top management commitment"
 - *Group 2*: consists of "provide sufficient resources", "provide training/education", "introduce an incentive system", "enhance understanding of processes", "support communication at all levels", "create and define performance measurements" and "define specific goals".
 - *Group 3*: consists of "project management".

The grouping of CSFs can support the efforts of management to focus on relevant factors. The SLSS framework can provide decision makers with a more

realistic representation of the relevance of each CSF for sustaining LSS in the healthcare organisation. It is a good alternative compared to the common way of considering every CSF's relevance to be equal.

8.4 Research Limitations

This research could benefit from a real business case implementation of the SLSS framework. However, such a real case - as repeatedly stated - would demand a long-term commitment of at least 5 years, which was not feasible for this study. Hence this research was subject to time limitations.

The data gathering part of this research was subject to several limitations. The survey focused on hospitals in Europe and obtained substantially less participants from outside the UK. This research therefore presents more cases from the UK than other countries, which could inhibit the generalisability.

The ISM model was not statistically validated. A proven approach for statistical validation is provided by the Structural Equation Modelling (SEM). SEM models can be tested by using LISREL or AMOS. However, it is important to note that SEM cannot develop an idea (model) itself. ISM on the other hand has the capability of developing a model based on managerial techniques. For this research the idea resulting in structuring the CSFs was sufficient and statistical validation was not perceived as mandatory at this step.

Additionally, despite obtaining eleven CSFs, this research cannot argue that it has covered all possible CSFs for sustainable LSS in healthcare. It is also observed that the line drawn between CSFs in healthcare and manufacturing contexts is very fine permeable. Besides different terminology, there is no evidence indicating that CSFs in a healthcare environment differ from CSFs in a manufacturing environment.

8.5 Recommendations for Further Research Work

For future research, the framework should be tested in a hospital and the outcome should be monitored yearly. The answers to following questions should be pursued to better understand the integration process: Do staff members address each CSF, or are some neglected? If they are neglected, what are the reasons? How are CSF addressed? Do projects fail despite addressing each CSF? How is the concentration on the CSFs after 1,2,3,4 and 5 years? The answers to those questions would be a valuable contribution to the framework and the journey to sustain LSS. In addition, a real business case can create best practices for approaching each CSF. Hence the approaches presented in Chapter 6 could vary strongly according to the preferences of the business case hospital.

Leadership skills were addressed as an important factor during the validation process. Despite the researcher perceiving it as a top management commitment, this was not clearly communicated. Considering leadership skills as a CSF would mean to assess its relevant influence to other CSFs. It can be considered to address leadership skills as a CSF and analyse its positioning, respective to its driving/dependence power.

The SLSS framework represents an approach to sustain LSS at an organisational level. The focus hereby lies on integrating factors that are critical for sustaining LSS into an organisation such as a hospital. It would be of interest to observe how well the SLSS framework could complement existing implementation frameworks such as DMAIC or PDCA. Both frameworks focus on implementing LSS (project wise) in an organisation using a set of tools available. The SLSS framework ends where DMAIC and PDCA start, meaning that in Phase D, the rules for managing projects are introduced. The use of SLSS would most likely positively influence the success rate in which LSS is implemented, as projects can benefit from higher top management commitment, good training, well-defined goals and so forth. Being able to benchmark the outcome of projects from before introducing SLSS with the outcome after

introducing SLSS would without doubt contribute to the rare knowledge of sustaining LSS in healthcare.

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APPENDIX A: Hospital Survey-Questionnaire

Sustainable Lean Six Sigma in Healthcare

Dear survey participant,

I am a 1st year PhD Student at Sheffield Hallam University. This survey is a crucial part of my research in order to create a framework which focuses on the long-term usability of Lean Six Sigma in healthcare.

Lean Six Sigma is known throughout industries since decades and has proven reliable and useful. Hospitals have successfully used Lean Six Sigma, too. Among those that stand out are Virginia Mason Medical Centre in Seattle, and Royal Bolton Hospital in Bolton. Both have created their own methodology based on the Toyota Production System, which seeks to steadily improve.

Please take up to 10 minutes to fill out this survey.

I will gladly send you the results of the survey in appreciation for your participation.

Kind Regards
Marco Matteo
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Sustainable Lean Six Sigma in Healthcare

Q1: How long have you been working with Lean and/or Six Sigma techniques?(In case you have never dealt with Lean and/or Six Sigma the survey will jump to the end.)

- ☒ --Click Here--
Have never used Lean and/or Six Sigma
☐ Up to 6 months
☐ 7-12 months
☐ 1-2 years
☐ 2-5 years
☐ 5-10 years
☐ 10 years +

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[Back](#) [Reset](#) [Next](#)

Sustainable Lean Six Sigma in Healthcare

Basic Information

Q2: Country?

--Click Here--

Q3: Institution's name? (optional)

Q4: Department?

--Click Here--

Q5: Job titel? (optional)

Q6: Number of Employees?

Q7: Number of beds?

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[Back](#) [Reset](#) [Next](#)

Sustainable Lean Six Sigma in Healthcare

Initial exposure and further learning

Q8: Who introduced Lean and/or Six Sigma to your organisation? (multiple responses possible)

- | | |
|-------------------------------------|--------------------------------------|
| <input type="checkbox"/> Your Staff | <input type="checkbox"/> Government |
| <input type="checkbox"/> Management | <input type="checkbox"/> Consultants |

Q9: Why did your Hospital choose Lean and/or Six Sigma as preferred technique for process improvement?

Q10: Did the hospital organise any formal training in Lean and/or Six Sigma?

- | | |
|---------------------------------|--------------------------------------|
| <input type="radio"/> Lean | <input type="radio"/> Lean Six Sigma |
| <input type="radio"/> Six Sigma | <input type="radio"/> None |

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Back

Reset

Next

Sustainable Lean Six Sigma in Healthcare

Selection of Process improvement techniques and project arrangement

Q11: Which of these Lean Six Sigma/Change Management tools do you use? (multiple selection possible)

- | | | | |
|--|--|---|---|
| <input type="checkbox"/> 5S | <input type="checkbox"/> Fishbone diagram | <input type="checkbox"/> Project charter/plan | <input type="checkbox"/> Control chart |
| <input type="checkbox"/> 5 Whys | <input type="checkbox"/> Histogram | <input type="checkbox"/> Process mapping | <input type="checkbox"/> Statistical Software |
| <input type="checkbox"/> ANOVA method | <input type="checkbox"/> Gauge R&R | <input type="checkbox"/> Value Stream Mapping | <input type="checkbox"/> TPM |
| <input type="checkbox"/> Brainstorming | <input type="checkbox"/> 8D | <input type="checkbox"/> OEE | <input type="checkbox"/> TRIZ |
| <input type="checkbox"/> DOE | <input type="checkbox"/> KANBAN/Line balancing | <input type="checkbox"/> QFD | <input type="checkbox"/> Visual Controls |
| <input type="checkbox"/> DFSS | <input type="checkbox"/> Poka-Yoke/mistake proof | <input type="checkbox"/> Simulation | <input type="checkbox"/> Voice of Customer |
| <input type="checkbox"/> FMEA | <input type="checkbox"/> Pareto analysis | <input type="checkbox"/> SIPOC | <input type="checkbox"/> Critical to Quality |

Other

Q12: Why do you use these tools?

Q13: How are projects prioritised?

- ☐ Quick wins
☐ Project with highest workload first
☐ No prioritisation

Q14: Who are in project-teams?

- ☐ solely external consultants
☐ external consultants + Management
☐ external consultants + Management + Staff (Nurses, Doctors...)
☐ Management + Staff

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Back

Reset

Next

Sustainable Lean Six Sigma in Healthcare

Implementation

Q15: Does the implementation follow a structured approach?

- ☒ DMAIC (Define, Measure, Analyse, Improve, Control)
☐ PDCA (Plan-Do-Check-Act)
☐ NHS Work Process Methodology
☐ No

Other approach

Q16: Why was this approach chosen?

Q17: What are the main issues you encountered when implementing Lean and/or Six Sigma? (multiple response possible)

- | | |
|--|--|
| <input type="checkbox"/> Resistance | <input type="checkbox"/> Lack of communication |
| <input type="checkbox"/> Lack of commitment | <input type="checkbox"/> Lack of support |
| <input type="checkbox"/> Lack of Tools-knowledge | <input type="checkbox"/> Hasty implementation |

Q18: Did you begin with a pilot-project to asses feasibility?

- ☐ Yes
- ☐ No

Q19: If No: Why?

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Back

Reset

Next

Sustainable Lean Six Sigma in Healthcare

Review

Q20: What is the overall opinion of Lean and/or Six Sigma in your hospital?

- ☒ Extensively supported and valued
- ☐ Moderately supported and valued
- ☐ Very little supported and valued
- ☐ Not valued and supported

Q21: What benefits have you achieved from using Lean and/or Six Sigma? (multiple response possible)

- ☐ Low costs
- ☐ Improved Quality
- ☐ Organisational benefits (e.g. change of procedures or rules)
- ☐ Cultural benefits (e.g. more motivated staff)
- ☐ Improved delivery (e.g. patients lead-time reduced)

Other

Q22: Did the results meet your expectations?

- ☐ Yes
- ☐ No

Q23: On which area did Lean and/or Six Sigma had the most impact?

- ☐ Medical services
- ☐ Pharmaceutical operations
- ☐ financial processes
- ☐ Administrative processes
- ☐ Information System

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Back

Reset

Next

Sustainable Lean Six Sigma in Healthcare

Sustaining Change mentality

Q24: How was the need (sense of urgency) for Lean and/or Six Sigma communicated in your hospital?

- ☒ High need
- ☐ Moderate need
- ☐ Very little need
- ☐ No need

Q25: How are projects initiated? (top-down and bottom-up processes refer to processes that flow from either the top or the bottom of the information processing hierarchy. Top-Down: Management drives and implements projects. Bottom-Up: Staff drives and implements projects. Top-Down and Bottom-Up: Management prioritizes and decides projects and staff provides ideas for projects and executes them.)

- ☐ Top-Down
- ☐ Bottom-Up
- ☐ Top-Down and Bottom-Up


Q26: In your opinion did every member of the team had a clear understanding of the goals and objectives of the project?

- ☐ Yes
- ☐ No
- ☐ Not everyone

Q27: How did you share the outcomes of the project?

- ☐ Own department
- ☐ Cross-departmental
- ☐ Only people involved in the project

	Extensively (over 75%)	Modest (about 50%)	Very little (under 25%)	Never
Q28: To which extent are old rituals and routines disposed and new ones established?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q29: To which extent is staff supported to speak out when codes of practice, standards or ethics are violated? (The question aims at your working environment. E.g. Is staff supported to speak out when safety is of concern? Are concerns taken seriously?)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q30: To which extent are nurses actively involved in redesign of processes in projects?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


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Sustainable Lean Six Sigma in Healthcare

Thanks for your patience!

If you are interested in the results of this survey, please provide your email. Your email will be kept confidential and solely used to send you the results of the survey!

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APPENDIX B: Performance Measurement type & hazard

Performance Measurement - Data type

Clinical	<p><i>Includes:</i></p> <p>Patient outcomes; data on health status; patient functionality; screening or prevention activities.</p> <p><i>Example of measures:</i></p> <p>Surgical interventions; medication therapy; special and diagnostic procedures; blood usage; infection control activities; immunisation status etc.</p>
Perceptions of care or patient satisfaction data	<p><i>Measures:</i></p> <p>Whether care provided was correct and appropriate; whether environment was pleasant, comfortable and conducive to recovery</p> <p>This type of data is usually obtained by letting patients fill out a satisfaction questionnaire. Traditional response rate is less than 35% as the ones filling out the questionnaire are usually either very pleased or displeased.</p>
Financial data	<p><i>Includes:</i></p> <p>Data on length of stay; disenrollment rates, charges; reimbursement problems.</p> <p><i>Example of measures:</i></p> <p>Return on Investment; margin rates; operating profit rates; profitability; liquidity; financial activity measures etc.</p>
Employee satisfaction data	<p><i>Includes:</i></p> <p>Absenteeism; employee turnover; grievances; perceptions of safety; workplace accidents; employee views of management; career opportunities; employee perceptions of the work environment; opinions on recognition, benefits, job security and communication</p>

Performance Measurement - Potential hazards

Tunnel vision describes the concentration on areas covered by performance measurements excluding important areas which for several reasons lack measures. Causes might be the difficulty in creating measures or that measures

are not directly relevant to the performance of Top management. In healthcare a common improvement objective is to meet waiting-list targets. A tunnel vision is present when the measures would be diverted to managing the list and therefore improving ratings of the hospital rather than focusing on prioritising measures according to clinical need.

Sub optimisation occurs when the focus lies on meeting sub targets and ignoring the bigger picture - the objectives of the whole system. Project teams consisting of members from multiple disciplines may pursue targets from their own discipline as they are specialised in that specific discipline not taking into account the impact on the outcome for the patient. Goddard et al. (2002, p.549) argue that a possible reason for the success of "the cancer collaboration pilots in reducing waiting times may be that the whole multidisciplinary team was made responsible for meeting targets".

Myopia describes the attention bestowed upon short-term issues rather than considering long-term issues. In a healthcare setting this would mean the focus of indicators on curative and not preventive services.

Complacency is present when a lack of motivation results in performances just being good enough although potential for better performance exists. An example would be accepting having a mediocre surgical performance, hence being in the middle of the national distribution and focusing on parts of the hospital where performance is poor (ranking-focused).

Measure fixation occurs when targets supported by little evidence are set. An indicator such as the two-week maximum waiting time for cancer referrals has measure fixation tendencies. Meeting the target creates a bottle neck along the process as it also includes patients which might have cancer therefore increasing the overall length of time to treatment for cancer patients.

Misinterpretation is present where performance measures allow incorrect inferences about performances. A classic example is the failure taking into account different factors in interpreting hospital rankings. It is imperative to work on producing indicators, which are meaningful and comparative. The mortality

rate indicator can be misinterpreted and used as a judgment of quality work in the hospital. The Royal Bolton Hospital in Greater Manchester received devastating mortality rate in 2009 and ranked one of the lowest in UK. The mortality rate was 22% over average (<http://www.telegraph.co.uk/health/healthnews/6685967/Seven-deadliest-hospitals-identified-in-damning-Dr-Foster-report.html>). The hospital is pioneer in quality improvement activities in UK and is taken often as benchmark for other Hospitals. This discrepancy can be explained by taking a set of indicators into account. There is a possibility that the population in the area of greater Manchester has more health issues than national average or that high risk patients are above average referred to the Hospital.

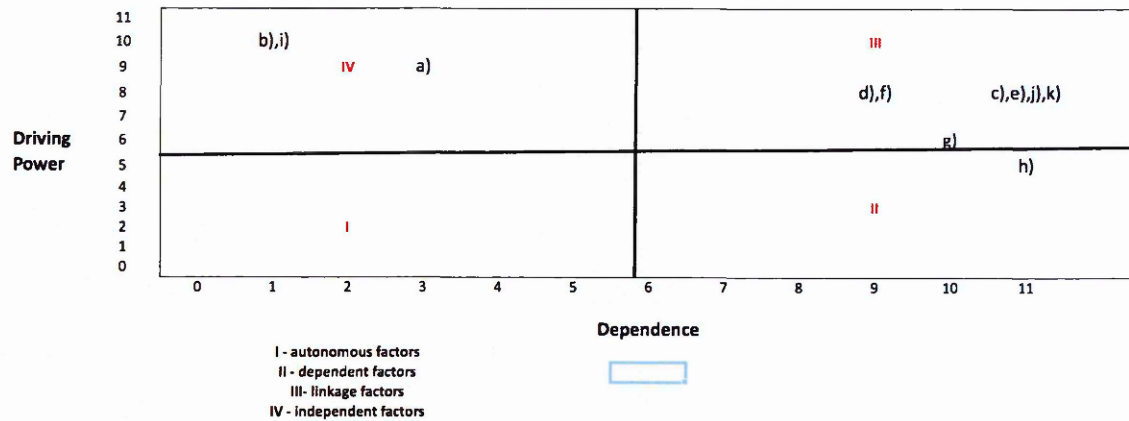
Gaming describes altering variables other than clinical quality in order to influence the measured performance. A common case would be creating an inadequate risk adjustment methodology by selecting low-risk patients and refusing high-risk patients to secure a favourable outcome.

Ossification describes the paralysis of an organisation that can happen when the system of measurements is excessively rigid. According to Tangen (2004) an information overload might happen caused by a large number of performance measurements. This will increase the difficulty in prioritising measures.

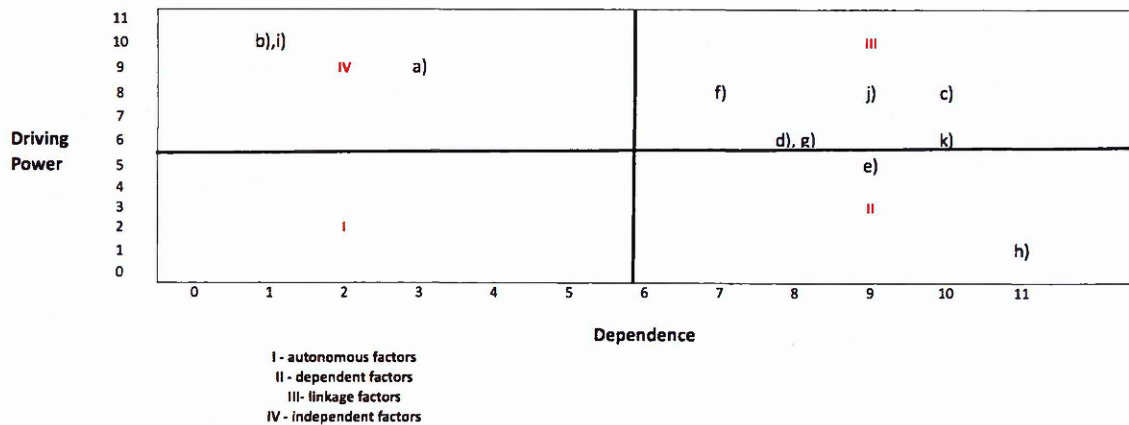
APPENDIX C: MICMAC threshold shift analysis & ISM Questionnaire

MICMAC analysis based on an incremental change of 0.1 in both directions of the threshold ($p=0.5$).

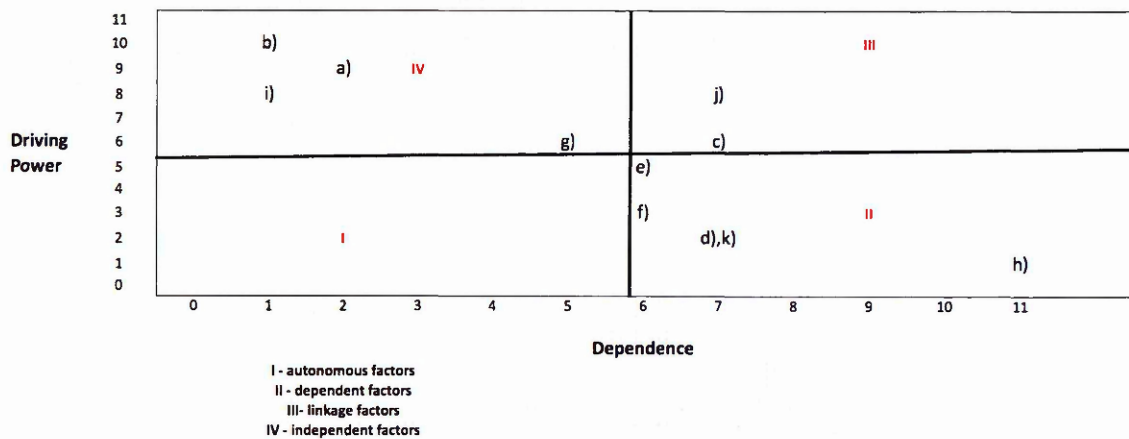
at $p \geq 0.4$



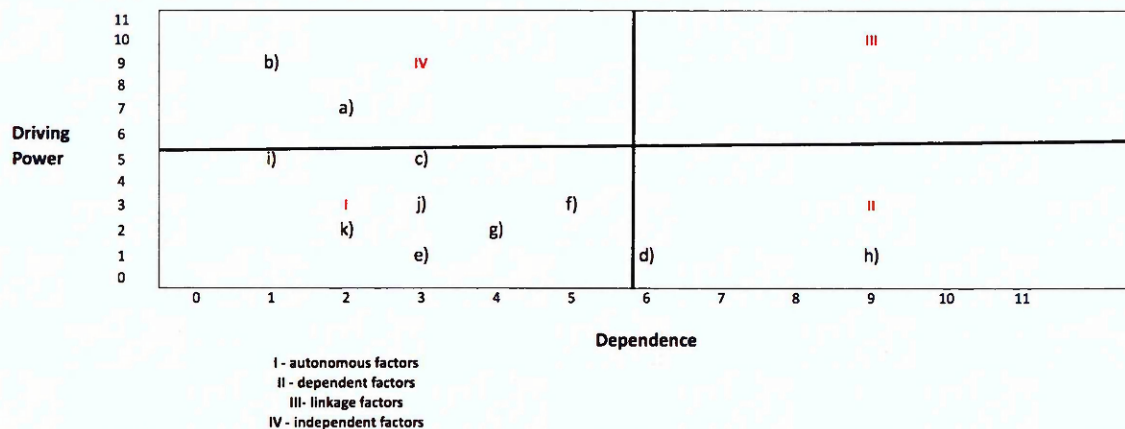
at $p \geq 0.5$



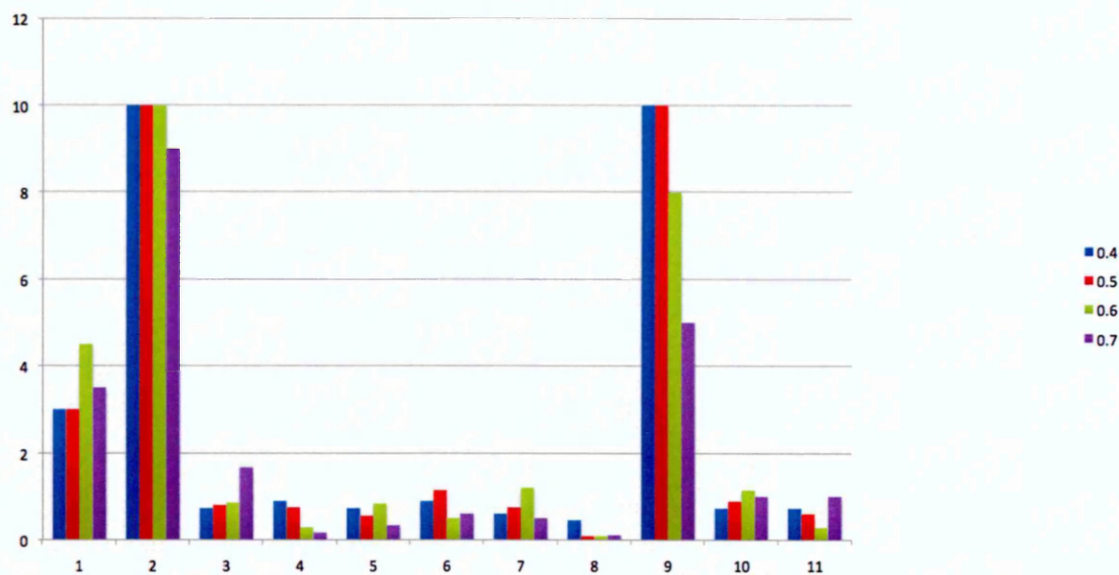
at $p \geq 0.6$



at $p \geq 0.7$



The figure below illustrates the driving/dependence power ratio in comparison to each incremental change of the threshold. The figure shows best which are the dominant and weak factors and how the power shifts when changing the threshold.



ISM - Questionnaire



**Sheffield
Hallam University**

SHARPENS YOUR THINKING

[Proceed to survey](#)

Dear Sir/Madam,

The purpose of this questionnaire is to assess the relationship between Critical Success Factors (CSF) in relation to Lean Six Sigma. These CSFs are part of a framework which will help Hospitals to embed Lean Six Sigma to achieve sustainable benefits.

With your help we will be able to create a sequence according to the relationship between each CSF outlined below:

- Top Management commitment
- High Sense of Urgency
- Clear Vision
- Clear defined Goals
- Performance Measurements
- Training/Education
- Communication
- Project Management
- Resources
- Incentive System
- Understanding of Processes

This should not take more than 10 minutes. Relationships between CSFs can be easily indicated using one of the four simple graphical connections.

If you have any queries about this questionnaire or would like more information about the research, please do not hesitate to contact Marco Matteo at: Marco.Matteo@shu.ac.uk

Please complete the questionnaire no later than 30 November 2011.

Thank you for your valuable feedback!

Yours Sincerely,

Marco Matteo

PhD Student

Sheffield Hallam University

Materials and Engineering Institute

Supervisor: Professor Terrence Perera

Supported by: SD&S Consulting

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Basic Info

Experience

(Lean and/or Six Sigma) ✓ Please select an answer

1 month - 12 months
1-2 years
2-5 years
5-10 years
over 10 years

Working area

Start survey

Survey

Description

-----> means that left side will help achieve right side

<----- means that right side will help achieve left side

<-----> means that left and right side will help achieve each other
will not achieve means there is no relationship between each side

Signed up!

Top Management commitment

will help achieve

Please select an answer

Clear Vision

Please select an answer

Clearly defined goals

Please select an answer

Effective Training/ Education

Please select an answer

Good Communication on all Levels

Please select an answer

Resource availability

Please select an answer

Incentive System (financial or motivational)

Please select an answer

Effective Project Management

Please select an answer

High Sense of Urgency

✓ Please select an answer

Understanding of processes

----->

Good Performance Measurement

<-----

<----->

will not achieve

Clear Vision*will help achieve*

- Please select an answer ☐ Clearly defined goals
- Please select an answer ☐ Effective Training/ Education
- Please select an answer ☐ Good Communication on all Levels
- Please select an answer ☐ Resource availability
- Please select an answer ☐ Incentive System (financial or motivational)
- Please select an answer ☐ Effective Project Management
- Please select an answer ☐ High Sense of Urgency
- Please select an answer ☐ Understanding of processes
- Please select an answer ☐ Good Performance Measurement

Clearly defined goals*will help achieve*

- Please select an answer ☐ Effective Training/ Education
- Please select an answer ☐ Good Communication on all Levels
- Please select an answer ☐ Resource availability
- Please select an answer ☐ Incentive System (financial or motivational)
- Please select an answer ☐ Effective Project Management
- Please select an answer ☐ High Sense of Urgency
- Please select an answer ☐ Understanding of processes
- Please select an answer ☐ Good Performance Measurement

Effective Training/Education*will help achieve*

- Please select an answer ☐ Good Communication on all Levels
- Please select an answer ☐ Resource availability
- Please select an answer ☐ Incentive System (financial or motivational)
- Please select an answer ☐ Effective Project Management
- Please select an answer ☐ High Sense of Urgency
- Please select an answer ☐ Understanding of processes
- Please select an answer ☐ Good Performance Measurement

Good Communication on all Levels*will help achieve*

- Please select an answer ☐ Resource availability
- Please select an answer ☐ Incentive System (financial or motivational)
- Please select an answer ☐ Effective Project Management
- Please select an answer ☐ High Sense of Urgency
- Please select an answer ☐ Understanding of processes
- Please select an answer ☐ Good Performance Measurement

Resource availability*will help achieve*

- Please select an answer ☐ Incentive System (financial or motivational)
- Please select an answer ☐ Effective Project Management
- Please select an answer ☐ High Sense of Urgency
- Please select an answer ☐ Understanding of processes
- Please select an answer ☐ Good Performance Measurement

Incentive System (financial or motivational)

will help achieve

Please select an answer

Effective Project Management

Please select an answer

High Sense of Urgency

Please select an answer

Understanding of processes

Please select an answer

Good Performance Measurement

Effective Project Management

will help achieve

Please select an answer

High Sense of Urgency

Please select an answer

Understanding of processes

Please select an answer

Good Performance Measurement

High Sense of Urgency

will help achieve

Please select an answer

Understanding of processes

Please select an answer

Good Performance Measurement

Understanding of processes

will help achieve

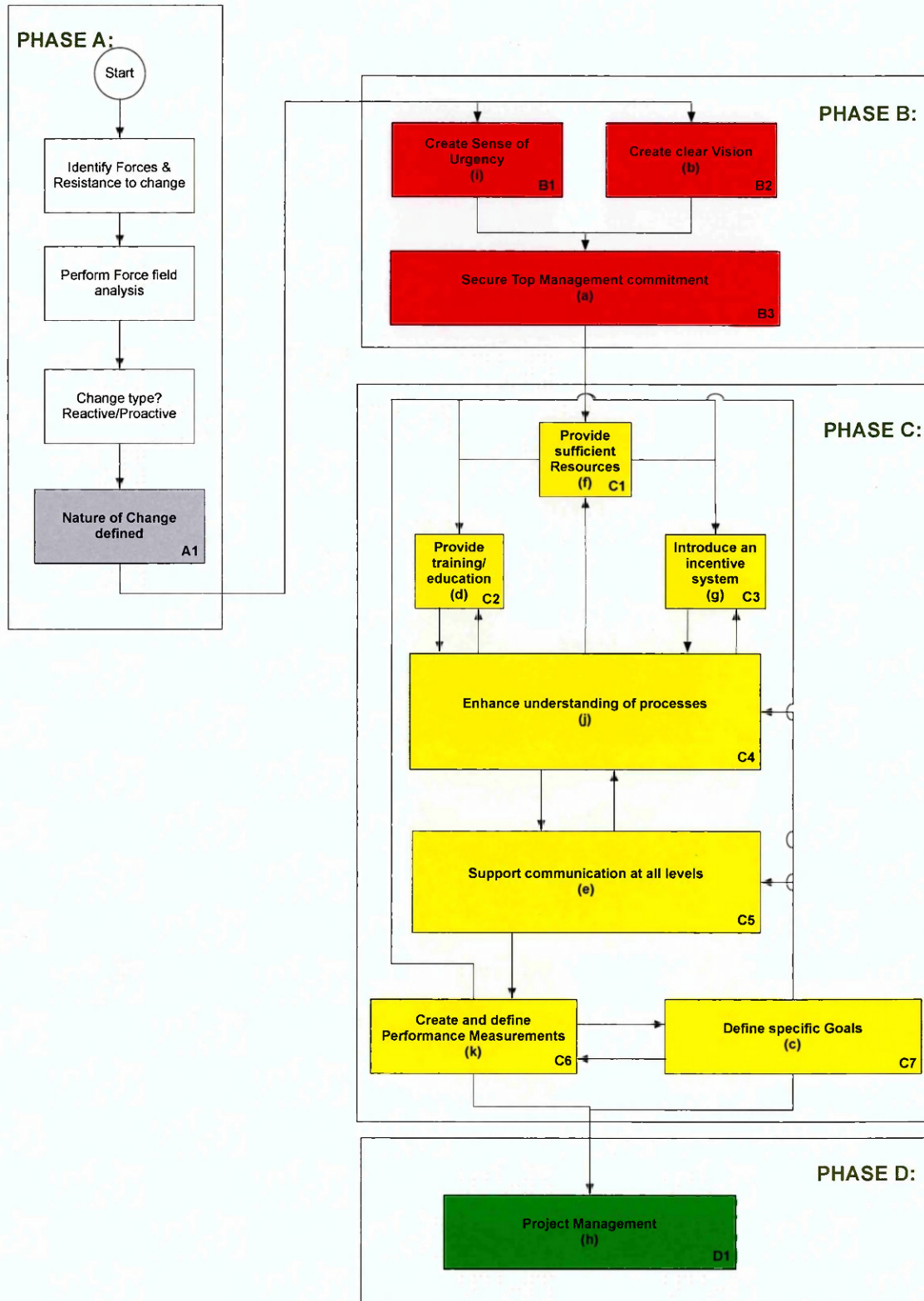
Please select an answer

Good Performance Measurement

Submit survey

APPENDIX D: Validation Questionnaire with summarised results

Each Phase has to be followed consecutively. The factors in each Phase are ordered by driving (influence) power but do not implicate a necessary order!





BACKGROUND

All eleven elements shown in Phases B, C and D are critical (CSF) for the successful integration of Lean Six Sigma (LSS) in an organisation. The CSFs are highly relevant for the integration of LSS and ignoring a single CSF will endanger the whole integration process. However, it is possible to order the factors based on their immediate influence on the integration process. The researcher made use of a method to obtain the relationship between each CSF. Hence, the structure of the framework is based on the results of a survey conducted in 2011. Prior to conducting the survey, CSFs were derived from literature (journals) based on 2 conditions: the paper was focusing on Lean and/or Six Sigma and it was either in a healthcare or not mentioned sector background. All other mentioned sectors such as manufacturing, government, banking etc. were not considered.

à **The Framework starts from the Organisation level and finishes with the Project level.**

à **The Framework orders each factor according to its importance as a whole for the integration of LSS:**

If Phase B is weak the integration of LSS should not *start*,

if Phase C is weak the integration of LSS is likely to *fail*,

if Phase D is weak the integration may not be *sustainable*.

The arrows shown in the framework represent the influence of the factor. Hence, arrows pointing against the process flow do not represent process steps or loops but direct influence (e.g. factor (k) has an influence on factor (d) and not on the following factors (j) and (e)).

Phase A assesses the readiness of an hospital to integrate Lean Six Sigma. Forces and resistance to change are compared and resistance is tackled. In addition, based on the outcome of the Performance force field analysis a prediction on the possible change path an organisation might follow is presented.

Phase B represents the Red traffic light, indicating that when factors are neglected the integration of LSS can not start. Meaning that any further activity towards integrating LSS will not deliver the desired outcome.

Phase C represents the Yellow traffic light, indicating that the factors are unstable and need special attention. These factors will have a heavy influence on the sustainability.

Phase D represents the Green traffic light, indicating that the factors have no driving power, hence they do not influence other factors in the system. This Phase has a project scope, meaning that it will not directly endanger the integration of LSS, however when Project management fails over time -> projects will fail resulting in LSS not being sustained.

VALIDATION QUESTIONNAIRE

of the SLSS Framework

= 5 out of aimed 5 participated. Each having 10+ years of exp. in application & research of LSS

In your opinion have all elements for sustainable LSS been captured?

- ☐ Yes - **4/5**
- ☐ No
- ☐ Not sure - **1/5**

→ Consider "Leadership skills" as CSF. Include it with Top Management commitment

→ "Leadership skills" can be a CSF beside Top Management commitment and has shown to differ from it. The skills are necessary to assess the possibility of successfully driving change. If skills are weak changes may fade after some years.

→ "Leadership skills" should be addressed, either as a single CSF or addressed under Top Management commitment.

In your opinion do you agree on the order of priority (structure)?

- ☐ Yes - **3/5**
- ☐ No
- ☐ Not sure - **2/5**

→ Makes sense

→ Agree totally with the sequence regarding the Phases. Questionable is the sequence regarding each element, it might change depending on who assess it. Also check if "Resources" might be included into training/education

→ Good structure. Some elements positioning may change. For instance Communication should be positioned higher in the sequence.

In your opinion is the framework easy to understand?

☐

Yes - **4/5**

☐

No

☐

Not sure - **1/5**

→ Information provided for the framework is sufficient and introduces each Phase well. I may suggest a slight change in order of the text. E.g. In the background text Phase A is not mentioned, it comes later in the middle of the paper and is somehow confusing.

→ Note that the Phases are sequential. As you say the elements are not necessarily sequential but illustrate relationship between the elements.

→ When I see arrows I expect a strict sequential order of elements, which has to be followed step by step. Therefore the part where arrows are explained is a bit confusing

In your opinion is the framework transferable?

☐ Yes - **5/5**

☐ No

☐ Not sure

→ Very transferable

→ Can be adopted in manufacturing as it depicts factors important from an organisational perspective

→ I could very well imagine using this framework in my line of work (service sector - non healthcare)

In your opinion does this framework help to achieve sustainable LSS?

☐ Yes - 5/5

☐ No

☐ Not sure

→ It depicts the level of focus very well. Starting from organisation level (soft facts) and ending at project level (hard facts). I could imagine this framework helping Top Management to sort out ideas and focus on what is important, getting the basics straight prior to starting projects. An organisation using this framework would think twice before embarking unprepared in improvement projects.

→ It will make it easier for Top Management to sustain LSS as all elements have been addressed and ways to reach a good understanding of the elements has been provided

→ Definitely assures sustainability when each CSF is addressed properly. Ways to do so have even been proposed on the following pages. However, I would also see this framework working well with other improvement philosophies such as TQM for example.

Do you have any suggestions for improvement?

☐ Yes - 3/5

☐ No - 2/5

☐ Not sure

→ Recommend no strict sequence of elements. Sequence of phases is logical and even follows a proven method (ISM)/ Leaving the elements loose in each Phase may be better and just arrange according to importance (relationship)

→ Sustainability would be highlighted further if a (visual) loop would be in place signalling that sustainability is ongoing. So that when after a year we check on things we go back from "Project Management" to sense of urgency. This will allow us to keep the Management on track and not let any drive towards change fade. In service and manufacturing industries we can easily do this every year as we use our BSC to check on KPIs which in turn will help to generate sense of urgency.

→ Consider if organisations should start a change initiative despite having bad cards (referring to nature of change which allows the assessment of chances to drive change. It does not say organisation should NOT start when resistance is high, it rather suggests to reduce resistance and if not possible organisation will have to follow a specific change path.

Participant's Profile

Healthcare industry (2) =

over 20 years work experience with 12 and 10 years in LSS.
One is a Green Belt the other a Black Belt.

Researcher (1) =

10 years of experience in LSS, delivering training to SMEs and conducting several Improvement projects with the NHS. Holds the 2nd highest certificate in LSS, Black Belt.

Service Industry (2) =

over 15 and over 20 years of experience with Improvement techniques in operation in several companies. Both are certified Master Black Belt (highest certificate available).